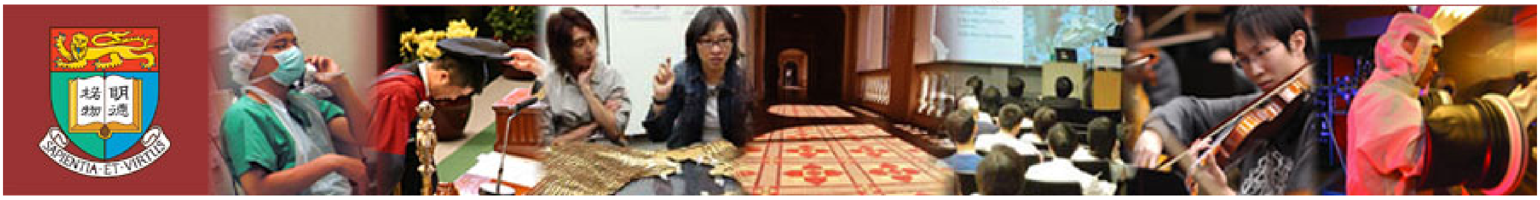

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THE UNIVERSITY OF HONG KONG

SCALE EFFECTS IN THE HONG KONG FRANCHISED BUS INDUSTRY: A COASIAN PERSPECTIVE

A DISSERTATION SUBMITTED TO
THE FACULTY OF ARCHITECTURE
DEPARTMENT OF REAL ESTATE AND CONSTRUCTION
IN CANDIDACY FOR THE DEGREE OF
BACHELOR OF SCIENCE IN SURVEYING

BY

CHEUNG CHO WING, ALVIN

HONG KONG

APRIL 2010

DECLARATION

I declared that this dissertation represents my own work, except where due acknowledgement is made, and that it has not been previously included in a thesis, dissertation, or report submitted to this University or any other institution for a degree, diploma or other qualifications.

Signature: ______________________

Name: ______________________

Date: ______________________

Witness by: ______________________

(Prof. Lawrence Wai-Chung Lai)

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Furthermore, I would like to express my thanks to my parents and brother for their love and affection; and Mr. Roger Chan and my classmates for their support. Without their support, this dissertation cannot be completed on time.

LIST OF ABBRIEVATIONS

CMB	China Motor Bus Company Limited
CTS	Comprehensive Transport Studies
FCC	Federal Communications Commission
KCR	Kowloon Canton Railway
KMB	Kowloon Motor Bus Company (1933) Limited
LRT	Light Rail Transit
LWB	Long Win Bus Company Limited
MTR	Mass Transit Railway
NLB	New Lantao Bus Company (1973) Limited
NWFB	New World First Bus Company Limited
PLB(s)	Public Light Bus(es)
RDS	Railway Development Study
TD	Transport Development
TKO	Tseung Kwan O

ABSTRACT

This dissertation is a standard econometric research on the scale economies of public transport in Hong Kong. The techniques used are Translog Production Equation and Cobb-Douglas Production Function. The data used are verifiable official data and statistics that span from 1950 to 2009, which have been published but have never been used by researchers.

The originality of this work lies in applying advanced production functions to data that have a span of almost 60 years. It is far more advanced and accurate than the pioneering attempt of my senior Ms. Sara Yang (Yang 2009). It is also novel by being informed by the Coasian thinking of the Department economists Prof. K W Chau, Prof. Lawrence Lai, Dr. K C Wong, Dr. Edward Yiu and Dr. Kelvin Wong.

The theme of this dissertation originates from Coase's (1937) work which identifies the objective and existence of a firm and explains that firms exist since they can avoid the transaction costs of individual production. This comparative advantage of a firm expands with its size, thereby leading to mergers and expansions. However, this additional advantage of firm expansion soon diminishes as decreasing returns to scale comes in. The determination of this scale

impact, as a matter of ‘resource allocation’, constitutes my current study of bus operations.

This dissertation aims to investigate the economic analysis of scale economies and apply them to the regime of public transportation. It covers several topics, and is informed by Coasian economic concept. This dissertation can be divided into two parts: the first part discusses the franchising framework of bus operation in Hong Kong, and identifies the rationale behind granting franchises in accordance with Coase’s idea (1959) of monopoly formation. The second part investigates the scale effect of different local bus companies, given that the production scale is a function of overhead costs and management fees. It evaluates the attempts of the two largest bus companies in Hong Kong to achieve economies of scale. The third part evaluates the impacts of conglomerate activities. This looks at whether when a bus company becomes conglomerated will affect the efficiency of resource allocation.

Besides economic theories, this dissertation also discusses the current town planning issues in Hong Kong, with special attention to transport planning. It looks into the transport planning of new towns, and how they affect the operation of bus companies. The influence of the Mass Transit Railway (MTR) in the provision of bus services is also discussed.

CHAPTER 1

INTRODUCTION

It is well known in the world that Hong Kong possesses a sophisticated transport system. In the urban area of Hong Kong, 3,400,000 people are settled in 70 sq. km. of land (HKSAR 2009: 266). Such a high density of living generates a huge demand for public transport. Everyday, the public transport sector (including the buses and railway) carries 11,273,000 passenger-journeys, representing 90% of total journeys travelled by locals (Table 2.1, Transport Department, Jan. 2010). Our transportation system therefore constitutes an important component of our lives, and plays the backbone for all economic activities of Hong Kong.

To ensure efficient and high-quality public transport services, an efficient use of resources and a clear institutional framework is important. These analyses fall under topics of property rights and institutional arrangements formulated in Coasian Economies. The allocation of resources can be evaluated by the scale benefits perceived by public transit companies. This determines whether these companies are managing well to utilize their resources; and whether it is financially viable for them to expand their operations. The fact that public transport facilities act as a form of public utilities also calls upon discussions of externality.

In Hong Kong, railways and franchised buses act as two major modes of transport, accounting for 35% and 34% of total journeys respectively (HKSAR 2009: 478). Studies of the Hong Kong railway sector have been carried out comprehensively in the past, both on the topics of patronage (Cheung et al. (2010)) and transit-oriented developments (TODs) (Chiang et al. (2004); Cervero, et al (2009)). Therefore, this study focuses on the less researched bus sector of Hong Kong.

Background

The earliest operation of public buses in Hong Kong can be dated back to 1921, when the Vehicles and Traffic Regulation Ordinance was amended to regulate Omnibuses (Leeds 1986: 22). Since then, bus services have developed rapidly. In the early days, the Government was supportive towards bus operations. Implicit contract items were offered by the Government in maintaining socially optimal services. These included private treaty grants (PTG) of land for depots and reserving sites for bus termini. The rationale behind such initiatives can be explained by Coase (1946) regarding marginal pricing and externality problems in achieving socially efficient productions. Starting from the 1970s, different events arose in the transport sector. Some of them affected the operation of bus companies, including the grant of cross-harbour routes in 1972 and the operation of the Mass Transit Railway (MTR) in 1979. All these constitute interesting topics for further studies.

Research Context

As an original empirical contribution to transport studies, this dissertation examines if and to what extent the business strategies of local bus companies overcome the problems of marginal pricing in line with Coase's (1946) solution by achieving economies of scale. In the past, many researchers have carried out detailed analyses on the operating conditions of public transport companies throughout the world. However, until now, none of them deal with the situation in Hong Kong, though our transport system here is renowned over the world for its high efficiency. Also, many local studies in the transport field, such as Wong (1995) and Tong (1997), are narrowed towards the policy side, which mainly state current policies and give sole descriptions of their impacts. Few of them look into the origin of these policies. This dissertation therefore supplements their studies by elaborating the policies in accordance with neo-classical economic theories, in a property rights and institutional approach. This dissertation also aims to supplement the gap of study areas and provide a comprehensive study of the transport sector in Hong Kong.

This dissertation also investigates to what extent bus companies benefit from their production scale, and evaluates their effectiveness. The two biggest companies in Hong Kong, the Kowloon Motor Bus (KMB) and the China Motor Bus (CMB) are chosen for further analysis. The current intention of the Government on town planning, which largely affects the operating conditions of bus companies, is discussed as well. This includes various protective measures granted to the railways instead of buses. More than that, this dissertation also shows the objective behind franchising, in addition to the common thoughts as a ‘revenue reaping’ mechanism to the Government.

Therefore, three aspects of neo-classical economics are stressed here: Franchising, Social benefits and Scale economies. All of these topics are based on the Coasian theories in welfare economics. This dissertation also considers theories in a practical side by looking at the real life scenario of Hong Kong.

The first attempt at Coasian studies in local transport was performed in Yang (2009). This dissertation differs from it by adopting a more comprehensive analysis. First of all, a more realistic and commonly-used ‘translog’ production function is used. Various costs (Fuel, Labour and Capital) are separately analysed, which offers opportunities for in-depth investigation into each factor of production. It also studies the cost effect of different events encountered by bus companies.

This study aims to achieve the following objectives:

1. Adopting Coasian theories to explain the phenomenon of bus operation in Hong Kong.
2. Developing a comprehensive insight into transport policies in a Coasian perceptive.
3. Evaluating in detail the operation of bus companies in Hong Kong.

4. Serving as a pioneer research to explore and initiate studies over local transport companies using a translog production model.
5. Investigating the current transport planning in Hong Kong and discussing their impacts.
6. Constituting a foundation for future researches on Coasian Economies in the public transport sector.

Organization

With reference to Turabian (2007), this dissertation is structured according to Chicago Style. It contains 7 chapters: Chapter 1 is the Introduction, which gives the aims and backgrounds of this study; Chapter 2 is the Literature Review, which looks into papers relating to this field. Definitions and relevant laws are also included; Chapter 3 considers the Hypotheses; Chapter 4 describes the Methodology; Chapter 5 gives the Empirical Findings; Chapter 6 gives a discussion of the results, and finally Chapter 7 gives the conclusion and limitations.

CHAPTER 2

LITERATURE & HISTORIC REVIEW

This chapter reviews the key definitions, the theories of Ronald Coase, ideas on franchising, research on economies of scale, and production models used in transport economic analysis, the concepts of franchising informed by Coasian concepts. This followed by a historic review of the bus industry in Hong Kong informed by economic theories.

Definitions

This part elucidates the definitions of two key concepts in this paper, franchising and economies of scale to set the context for further discussions in later chapters.

Franchising

The term ‘franchise’ is used to describe a price-mediated exchange for an exclusive right of a particular activity (Mathewson and Winter 1985: 2). The International Franchise Association, the oldest franchise-granting organization in the world, defines franchising as a *“continuing relationship in which the franchisor provides a licensed privilege to do business, plus assistance in organizing, training, merchandising, and management”*.

Between private parties, a franchisee pays a certain sum of money for a right to market a product, (Rubin 1978: 3). In a franchise for public services, a contract is made between a public (the franchiser) and a private body (the franchisee) (Nijkamp and Rienstra 1995: 2). Under institutional economics, it can be regarded as a hybrid between a firm and a market (Rubin 1978: 10). A typical franchise contract involves a transfer of an exclusive right and a fee (the so called 'royalties') (Mathewson and Winter 1985: 3), which helps raise capital for the franchisor (Rubin 1978: 4). One famous example is the grant of radio licences, which has been widely elaborated in Coase (1959). Details of this regulatory framework are discussed in later chapters of this dissertation.

Economies of scale

Topic of 'Economies of scale' (or 'scale economics') has accumulated rich studies in applied economics. In general, this term can be defined as a situation in which *"a product is made more profitable by manufacturing it in larger quantities so that each unit costs less to make"* (Collin 2006: 59). In other words, it refers to a situation when the average cost of production decreases with an increasing scale of a firm. This explains a widely acknowledged phenomenon that larger organizations or countries can produce goods or services at lower unit price than the smaller ones. A contradiction to this term is 'diseconomies of scale', in which average production cost is boosted when production increases (Collin 2006: 53). This may be one result from over-expansion of a firm, as suggested in Coase (1937). Studies of this aspect are mainly dedicated to identifying the optimal scale of firms. Examples include Berechman (1983); Lee and Steedman (1970); and de Borger (1984).

This concept of scale economies can be illustrated by the diagram below:

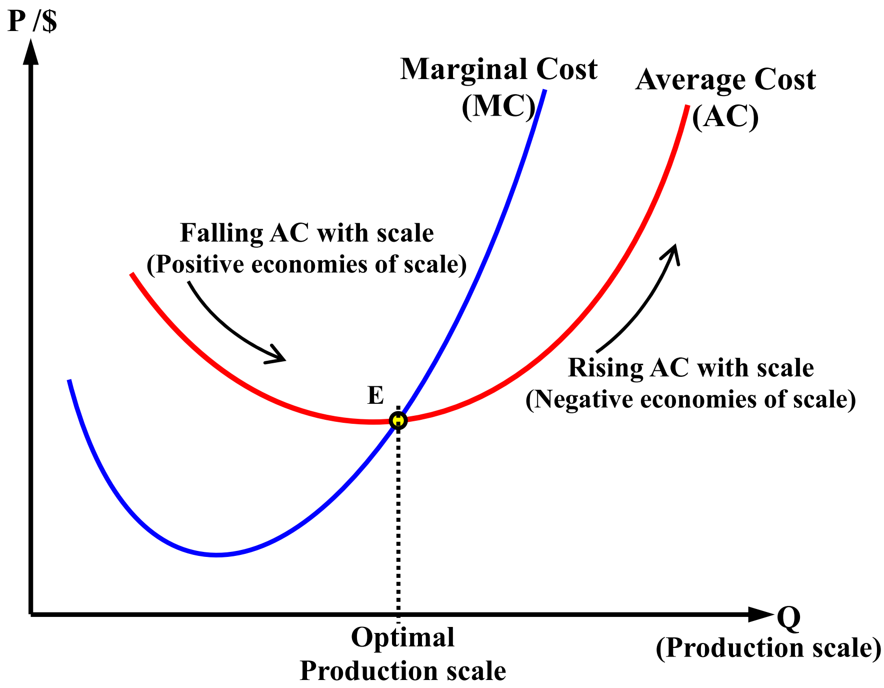


Figure 2.1 Scale effects of a production firm

Therefore, to determine whether a manufacturer faces positive or negative scale economies, it is important to derive a cost function and calculate the slope of the Average Cost curve at a specific production scale, or in mathematical terms, $\frac{\delta AC}{\delta Q}$.

A re-visit into Coasian theories

This section covers the economic ideas of Coase. Here, we limit our focus to the following concepts: public utilities, franchising and scale benefits.

<u>Provision of public utilities</u>

Discussions regarding public utilities have been carried out widely in the field of welfare economics. One famous paper is Coase (1946), which states a situation that:

> *"when average costs are decreasing, marginal costs are less than average costs, the total amount paid for the product will fall short of total costs"* (Coase 1946: 169)

This outlines the common problem for public utilities. In such goods, there exists a divergence between average cost and marginal cost (Coase 1946: 174). If firms follow the traditional approach of marginal cost pricing, which is a situation under free competition, they may be unable to recover their full costs of production (Havlik 1938: 92; Coase 1946: 174). However, if full costs are charged, the fee would be too high and deter the public from using the utilities (Coase 1946: 182). In other words, without market intervention, the possible revenue obtained from a customer will be less than the relevant cost. The paper explains this production problem with Hotelling's example of a bridge. It mentioned that the production cost of each consumer unit should account for the cost for the carrier, which is far more than the cost of serving an additional customer (Coase 1946: 171).

This divergence between average cost and marginal cost is more obvious in the sub-urban (or less-populated) towns. In those districts, the usage of services is less frequent than that in the urban district. However, as a public body which caters for social benefits, their needs for services should not be ignored (Coase 1946: 178). One example of these services is public transport. In this case, there will be a greater need for institutional support or market intervention by the Government.

The above concept of public utility is often used in the topics of road pricing, which aims to charge users according to individual demands. In our case, however, we are more interested in its implication: the need for 'external' support. In the paper, Coase suggested several solutions. One of them suggests that the Government should enter and take the responsibility to provide public services for the sake of public interest. This is expressed as follows:

"*The effect would be for consumers to pay for the cost of the product at the central market and for the Government, or rather the taxpayer, to bear the costs of carriage*." (Coase 1946: 171)

Another suggestion to this problem is to grant subsidies (Havlik 1938: 93; Coase 1946: 172, 174). That is, the Government provides financial incentives for producers upon the provision of socially sufficient services. In this case, the Government bears part of the production cost to ensure sufficient services (Coase 1946:

176).

The third suggestion is to adopt a multi-part pricing system, (Coase 1946: 180), which is a form of price discrimination derived from Monopoly (Button and Drexler 2005: 3). In such systems, the average revenue incurred from consumers is set to cover the average cost sufficiently. This leads to the occurrence of franchise (which is adopted in the public transport of Hong Kong), as a form of monopoly power (Caves and Murphy 1976: 8).

Lai et al (2008) also mentioned this market problem arising from marginal pricing of public utilities in an unregulated market. It demonstrates this scenario with the use of lighthouses. If lighthouse operators charge their services at marginal cost, which is a situation under free and unregulated market, the revenue it received (which is close to zero) will be too low to compensate for the long-term expenses for providing the services. (Samuelson 1964: 151; Coase 1974: 359; Lai et al. 2008: 404, 566) In other words, there exists an imbalance between the revenue and the actual running expenditure of services. To ensure the safety of ships and an adequate provision of lightings, Government intervention (such as subsidies) or some levels of monopoly (such as licensing) is therefore suggested (Lai et al. 2008: 567, 569). The latter approach permits operators to charge at reasonable prices or exhibits price discrimination (Lai et al. 2008: 577). This allows operating costs to be recovered by the receipts. This concept can be equally applied to other public utilities as well, such as public transportation.

Leeds (1986) observed this situation in the bus services of Hong Kong. In certain remote routes, a lower ridership is expected. There may incur a high imbalance between possible revenue and cost (Leeds 1986: 24). Historically, the Colonial Government adopted regulatory terms, cross-subsidization and certain implicit agreements to alleviate this problem. Details of this will be mentioned in later chapters.

Franchising as regulatory power

Besides provision of socially optimal services, franchising also serves as a regulatory mechanism. This proposition was described in Coase (1959). In the paper, Coase investigated the origin and effects of such a grant with respect to the radio broadcasting industry. At that time, the industry was regulated by the 'Federal Communications Commission' (FCC). An initial idea of franchising was to regulate the radio traffic and prohibit any interference of emergency channels (Coase 1959: 25). But it soon developed as a form of regulatory power upon the industry. This is addressed as follows:

> *"The Commission was authorized to issue a license if the 'public interest, necessity or convenience would be served'"*
>
> (Coase 1959: 6)

In the Coase (1959) case of broadcasting, when a broadcasting company renewed its licence, the Commission would see whether public interest was considered. This was to ensure that the licensee's act was according to a publicly accepted standard drafted by a licensing body (Coase 1959: 8). Also, in the franchise terms, broadcasting companies were restricted from transferring or selling their licence (Coase 1959: 7). These restrictions are similar to the franchise terms for bus companies in Hong Kong. (c16, Licence of CMB 1933; c17, Licence of KMB 1933)

The need for Government intervention upon public services is further supplemented in Coase (1974). It suggested that an anti-social situation would result from an unregulated provision of public services. It is stated in his paper that:

> *"Producers often exercise monopolistic power and, in any case, without some form of government intervention, would not act in a way which promotes the public interest"* (Coase 1974: 2)

Pigou (1932) also formulated similar concepts for Government intervention in welfare goods. It stated that it was *"worthwhile for the government to subsidize or tax private activities whenever the market produces too little of a good thing or too much of a bad thing."*

Similar analysis on the need for Government intervention is also discussed in Coase (1960) under topics of social cost.

Economies of scale

The next Coasian theme of this dissertation regards optimal production scale, which is originated from Coase (1937). In the paper which addressed the formation of firms, Coase stated that firms arised so long as the production cost faced by self-employed individuals through single contracts was high (Coase 1937: 392). Several economic researches extract this idea to argue for the tendency towards 'outsourcing' (due to the high cost of employment contracts). Our study is not devoted to this topic of sub-contracting, but its associated idea of firm scale. The paper subsequently suggested that the size of a firm is closely related to the associated production cost, which is extracted as follows:

"The actual point where the expansion of the firm ceases might be determined by a combination of factors mentioned above"
(Coase 1937: 395)

In the paper, the 'factors mentioned above' referred to the organization cost and negotiation cost. These include costs of employing various factor inputs. Several preceding literatures identify these costs as production costs and transaction costs faced by an entrepreneur (Rubin 1973: 937; Klein 1999: 21).

Situations of 'negative returns to scale' are also discussed in the paper. It identifies this situation as a result from over-expansion of firms. This point was raised with a famous question,

"If by organizing one can eliminate certain costs and in fact reduce the cost of production, are there any market transactions at all? Why is not all production carried on by one big firm?"
(Coase 1937: 394)

The above question limits the maximum production size of a firm. Expansion beyond this limit increases the average production costs (or can be regarded as over-expansion). It states that if firms increase their sizes continuously, they may place themselves into a stage of *"decreasing returns to the entrepreneur function"* (Coase 1937: 394). This criterion of diminishing benefit to scale is described as 'diseconomies of scale' in later literatures.

As discussed in Coase (1937), the problem of 'diseconomies of scale' is more likely to occur in a conglomerate firm, one which incorporates different kinds of production (Coase 1937: 397). In this case, the entrepreneurs have to place more efforts in allocating the production factors to a best use, which boost the organization and management cost. The risk of a loss incurred from mismanagement also increases. This extent of raising the production cost, according to the same paper, is closely related to the dissimilarity of transactions (Coase 1937: 397). This may be an explanation for the trend to fragmentation in US conglomerate firms to specialize their individual productions in the 1980s, and a reason to limiting product diversifications, as suggested in Bhide (1990).

As regards the optimal size of firms, Coase (1937) suggested that this should be determined by the cost of an additional transaction and the scale benefit it achieves (Coase 1937: 395). Beyond that point, negative scale return arises, which discourages further expansion. This gives rise to subsequent quantitative analysis of scale economics.

In-depth analyses in economies of scale have been formulated in different industries. In public transport sector, for example, Lee and Steedman (1970); and Obeng (1985), revealed that small bus companies in the U.K. suffered from negative scale economies in their operations. These findings provide supports to the widespread trend of conglomeration in the UK bus industry to reduce cost (Viton 1981: 301). This dissertation applies similar analysis to Hong Kong, and looks into the operating status of two large companies, China Motor Bus (CMB) and Kowloon Motor Bus (KMB).

Production models in transport economics

In applied economics, there exist numerous functions to represent the production of a public transport company. The results can serve as indicators to show the operating performance of that firm, which facilitate in-depth analyses for researchers and policy-makers. In transport studies, considerations are usually focused on consumer pricing and service efficiency, and are collectively regarded under the scope of ‘transport modelling’. Listed below are three commonly used models, as described in Díaz (1982):

Cobb-Douglas function

Cobb-Douglas Model is one of the earliest production models formulated in economies (Dreze et al 1966: 1). This model was initiated in Wicksell (1895), which stated that the production curve is a function of labour and capital (Wood 1994: 179). This was further elaborated and applied in Cobb (1928) to investigate marginal productivity of distribution (Bronfenbrenner and Douglas 1939: 8). A typical form of this production function is given below:

$$Q = A \cdot K^{\alpha} \cdot L^{\beta},$$

where: Q is the output; K is capital; L is labour; A,α, β are constants

Detailed analysis on its usage can be referred to in Bronfenbrenner and Douglas (1939); and Simon and Levy (1963).

Translog Production Equation

Translog Production Equation is one modified form of the Cobb-Douglas function (Hensher and Button 2000: 326). The term ‘translog’ suggests that the function is ‘transcendental logarithmic’ in nature. Some literatures, for example, Hensher and Button (2000), may classify this equation under the category of Cobb-Douglas Equations. Translog function was developed based on a limitation of the Cobb-Douglas Function, that the ‘elasticity of substitution between factors of production’ is assumed unity (i.e.σ= 1[1]) (Viton 1981: 3), which is rarely seen in transport operations (de Borger 1984: 11). In transport studies, the translog production function is the most commonly used model to estimate the scale effects (Hensher and Button 2000: 330). Mathematical details regarding this model will be discussed in later chapters.

Examples of its applications include Viton (1981); Obeng (1985); and Filippini and Prioni (2003).

Constant elasticity of substitution (CES) function

The CES production function was derived in Minhas et al. (1961). This model was built to overcome the limitation of ‘constant input coefficient’ in the Leontief Production Function (i.e. perfect complements for input) and ‘unitary elasticity of substitution’ in the Cobb-Douglas function (Minhas et al. 1961: 2). As the name implies, this function assumes a constant elasticity of

1. This can be shown by the following: $\sigma = \frac{\delta \ln(L/K)}{\delta \ln(MRS)} = \frac{\delta \ln(L/K)}{\delta \ln\left(\frac{\alpha}{1-\alpha} \cdot L/K\right)} = 1$

substitution.

The general expression of this function takes the following form:

$$Q = F \cdot \left[\sum_{i=1}^{n} a_i^{\frac{1}{s}} \cdot X_i^{\frac{s-1}{s}} \right]^{\frac{s}{s-1}}$$

where Q = Output

F = Factor productivity

a = Share parameter

X_i = Individual Production factors

s = Elasticity of substitution.

<u>Other ‘flexible’ models</u>

Apart from the above commonly-used production models, some researchers also develop their own models to suit specific scenarios (Hensher and Button 2000: 326). Most of them, for example, the generalized Leontief function in Diewert (1971); the generalized quadratic function in Denny (1974); and the generalized McFadden functions in Kumbhakar (1990), are built on the three ‘basic’ models listed above. These modified functions are also known as ‘Flexible functions’ in applied economies (Tae 1979: 382). Details of each method are not the theme of this dissertation, and therefore will not be discussed here. A list of economic models adopted in different transport studies is included in the Appendix 1.

Bus Industry in Hong Kong: An Historic Review

In Hong Kong, bus operation was regulated under franchise agreements. The history of regulating of the bus companies can be traced back to 1921, when an amendment was made to the Vehicles and Traffic Regulation Ordinance to grant "*exclusive rights for running a motor bus service in Kowloon and New Kowloon*" (Leeds 1986: 24). In 1931, a Committee was further appointed to regulate the territorial road transport.[2] Later, the Government intended to reduce the number of bus companies (from six to two) operating in Hong Kong for better regulation (Davis 1994: 1). This subsequently led to an open-tender for bus services in September 1932, and the first franchise was granted to Kowloon Motor Bus Company (for Kowloon and the New Territories routes) and China Motor Bus (for Hong Kong Island routes).

The initial franchise was granted for a period of 15 years (up to 11th June 1948). But bus services were unfortunately halted under the Japanese Occupation from 1941 to 1945. Therefore, a provisional licence was supplemented to both companies for temporary services during 15th February 1946 and 15th August 1946 (later extended to 15th August 1947). Since then, 15-year licences were granted to both bus companies until 1975, when a new 'Public Omnibus Services Ordinance' was passed. This ordinance restricted each franchise period to 10 years.

Since the 1990s, there were wide public discontent regarding

2. Appendix F, Tender Notice for Road Passenger Transport (1931), p.46

the services of CMB, especially for its aged bus fleet and high break-down rates (Wong 2001: 20). Similar opinions were also addressed in the Legislative Council Meetings as follows:

> *"… The past of China Motor Bus Company is a good example. Since the company was awarded a franchise, no improvement of service was seen. It is gratifying that the Government opens up 26 routes this year to introduce competition to bus services."* (Adapted from LEGCO Minutes on 22 October 1992)

As a result, in 1993, the Government took away 26 routes from CMB and awarded them to City-bus (CTB) for a trial term of 3 years, aiming to force CMB to improve its services. (CTB was a formerly non-franchised bus company in Hong Kong). However, the services provided by CMB were still not satisfactory (LEGCO Minutes, 18 June 1997). In June 1997, the Government decided not to extend the franchise of CMB. Its 88 routes were awarded to a new bus operator, the New World First Bus (NWFB).

NWFB was initially a co-owned company of 'New World Development Company Limited' (74%) and the First Group from the UK (26%). In March 1998, it was granted a 5-year licence to operate 88 ex-CMB routes commencing from September 1998. In 2000, New World Development acquired all the shares of NWFB. In 2003, both NWFB and CTB became subsidiary companies under Chow Tai Fook Enterprises and NWS Holdings Ltd. Since then, bus operation on Hong Kong Island was monopolized by one single enterprise.

Other franchise bus companies in Hong Kong include the Long Win Bus Company Limited (LWB) and the New Lantao Bus Company Limited (NLB). The former one (LWB) is a full subsidiary of KMB, and was licensed in 1996 to run part of the Airport and Tung Chung routes. The latter one (NLB) is responsible for bus services on Lantau Island (plus a cross-border route B2).

A summary of the franchise periods for the four major bus companies in Hong Kong (ex-CMB, KMB, CTB and NWFB) is shown as follows:

Table 2.1 Franchise Periods of Bus Companies

Bus Company	Year of Franchise Commenced (Period)
CMB	1947 (10 years) (later extended 2 years) 1959 (15 years) (later extended 1 year) 1975 (10 years) 1985 (4 years) 1989 (4 years) 1993 (2 years) 1995 (3 years[3])
KMB[4]	1947 (10 years) (later extended 2 years) 1959 (15 years) (later extended 1 year) 1975 (10 years) 1985 (10 years) (later extended 2 years) 1997 (10 years) 2007 (10 years)
CTB (Franchise 1[5])	1991 (3 years[6]) (later extended 2 years) 1993 (3 years[7]) 1996 (10 years) 2006 (10 years)
NWFB	1998 (5 years) 2003 (10 years)

A Coasian perspective in bus franchise of Hong Kong

Since 1933, the franchise arrangements for regulating buses in Hong Kong display various possible applications of Coasian theories, especially in welfare economics. In the aspect of public interest, the initiation of a franchise creates a monopoly initiative for operators to provide socially sufficient transport services

[3] The franchise of CMB was terminated in 31st August, 1998.
[4] The franchise of LWB is not included here
[5] Franchise 1 for CTB refers to bus operations of urban routes (North Lantau & Airport routes: Franchise 2)
[6] This franchise was granted in 1991 to operate an ex-CMB route, 12A
[7] This franchise was granted in 1992 to operate 26 ex-CMB routes

(Button 2005: 393). In previous chapters, it mentioned a divergence between average and marginal production costs exist for public utilities. This leads to potential problems of marginal pricing, and eventually causes under-supply of services under free market conditions (Coase 1946: 180). This point of securing socially sufficient transport services through franchising in Hong Kong is also mentioned in Leeds (1986)[8] and Wong (2001)[9]. This situation was coherent with the example of lighthouses, in which trinity houses were licensed to provide lighting services (Lai et al. 2008: 410).

As for the nature of the governing documents, it is not difficult to identify similarities between the Broadcasting example in Coase (1959) and our bus scenario. Both cases adopted franchising to safeguard public interest; both situations involved a competitive bidding process, in which rights was allocated to the highest bidder, (Coase 1959: 15; Tender Notice for bus Services 1933: 47); and both made strict restrictions upon the transfer of licence (Coase 1959: 22; c16, Licence of CMB 1933; c17, Licence of KMB 1933). In Coase's case, the property granted was a right to use the formerly public radio channels for public broadcasting. In our case, this right can be interpreted as the right to use public roads for public transport services.

In Economics, discussions of franchising mainly falls under two aspects: 1) profit-seeking initiatives; and 2) social governance

8 See P.24, Leeds (1986)
9 See P.8, Wong (2001)

(Rubin 1978; Mathewson 1985). Some literatures, for example, Eisenberg (1982) and Romano (1985), suggested that franchise revenue (or so called 'royalties') constituted a major objective of franchising. These revenues can therefore be used in public financing. For example, Eisenberg (1982) mentioned that *"franchise taxes may be a highly significant proportion of revenue"* (Eisenberg 1982: 188-189; see also Romano 1985: 231). Hazlett (1998) also suggested that franchising "*produces a great deal of revenue that could be used to subsidize public service programming*" (Hazlett 1998: 540).

In the case of the Hong Kong bus industries, the objective of franchising as a major source of income is not expressly mentioned by the Government. But in reality, both KMB and CMB were required under franchise terms to pay periodic sums (known as 'royalty') as follows:

'The Licensee shall pay to the Colonial Treasurer on the seventh day of each and every month in respect of the preceding month of this licence, including each and every month of any and every extension thereof (if any), the following royalty or percentages on such gross annual receipts of the Licensee"

(s.9 of the CMB Licence 1933, s.8 of the KMB Licence 1933)

Leeds (1986) also revealed that royalty payments by transport companies did reap a considerable amount of revenue for the Public Account in the past years. It mentioned that, *"Royalties were a common feature of the taxation system in Hong Kong. Right from the early days there had been vigorous resistance to any form of direct taxation and to raise revenue Government found it easier, both from the point of view of public opinion and administrative cost, to obtain a substantial part of its revenue from the sale of licences and monopolies"* (Leeds 1986: 25-26)

The handsome sum of royalties is also displayed in the Government Accounts. From the period 1934 to 1939, the actual receipts even out-perform the initial estimation (A1-3, Hong Kong Administrative Report, 1934–1939). The table below shows the amount of royalties received during the early periods:

Table 2.2 Royalties paid by bus companies, 1934 - 1939

Year	CMB (% Total government revenue)	KMB (% Total government revenue)
1934	$101,510 (0.343%)	$128,094 (0.433 %)
1935	$118,275 (0.416 %)	$117,505 (0.413 %)
1936	$124,088 (0.413 %)	$116,613 (0.388%)
1937	$128,708 (0.388 %)	$140,991 (0.425 %)
1938	$194,703 (0.530 %)	$225,672 (0.614 %)
1939	$257,874 (0.622 %)	$382,282 (0.922 %)

(Source: Section A1(3), Hong Kong Administrative Report, 1934-1939)

The original bus licence also incorporated other profit-seeking terms for the Colonial Government. One example is the restriction that every bus operated by the companies has to be manufactured by British companies. (s.4, CMB Licence 1933; s.3, KMB Licence 1933) These 'market-protection' tactics over domestic products constituted profit-seeking opportunities for the British Government.

The second aspect of franchising to promote regulatory power was, according to the Government, the main objective of franchising, (Leeds 1986: 24; Davis 1995: 1). This idea initiated in the 1920s when wide public dissatisfaction over bus services was expressed in Davis (1995). Various literatures also suggested that the original thoughts of the Government was "*to secure better services for the public*", which ensured that satisfactory services were provided (Leeds 1986: 24). This rationale of public benefit is similar to the 'FCC' example illustrated in Coase (1959), in which the Government's objective was to ensure that 'public interest, necessity or convenience would be served' (Coase 1959: 6).

In both licences for CMB and KMB, fares and routes were clearly defined in schedule-A. This was an attempt to serve two objectives: First, it prevents the over-charging problem (charging above the socially optimal level), which may arise from the market-failure situation under a monopoly regime (Coase 1974: 2). Second, it attempted to use the profitable urban routes to cross-subsidize the less profitable rural routes. In rural routes, the usual ridership may not be enough to cover the operating cost.

Therefore, without some kind of regulation or subsidies, these routes "*probably would not be served under free competition*" (Leeds 1986: 24). Or in some cases, the fare charged would be too high to be borne by the public. This problem is addressed in Coase (1946) as follows:

"*Consumers who live in regions of low density of population would probably not be willing to pay the total costs of supply of public utility services which in their case would be very high, and ... they would not be given the services*" (Coase 1946: 11)

The above argument constitutes the major reason for the Government to adopt a 'tied' mechanism in granting several (rather than individual) bus routes. This also ensures "a reasonable and acceptable price" was charged to the pubic (Cheng 1984: 31) for transport services and secures socially-sufficient public transport services in the less dense districts. (Leeds 1986: 24).

However, one problem of granting a franchise, according to Coase, was the monopolistic nature of the franchisee. It was pointed out in Coase (1974) that firms operating under a monopoly condition usually ignore quality issues and neglect social needs (Coase 1974: 2; see also Ch.2). This contradicts the basic objective of the Government to safeguard the interest of the general public (Coase 1959: 21)

To deal with this problem of market-failure, in both franchise documents for CMB and KMB in 1933, detailed conditions of bus services, for example, frequency and bus types, were listed in the Schedule A of the Franchise Agreement for CMB and KMB. The Governor was also empowered to inspect the transport activities by the two companies. (s.10, Licence of CMB 1933; s.9, Licence of KMB 1933)

Since the enactment of franchise conditions in early 1933, the franchise terms have been constantly modified in different periods to meet social objectives. One notable example was the change from regional franchise to route franchise in 1975. This offered a chance for the Government to introduce competitors more easily (Wong 2001: 86), and thus exerted more precise controls. All these ensured that the basic public interest was served and prevented quality issues arising from monopolies. This also gave rise to the introduction of CTB in later years.

A brief history of ordinances governing bus operations in Hong Kong is shown in Appendix 2.

The Mass Transit Railway (MTR)

Details regarding MTR operation are not the main theme of this dissertation. However, it affects heavily the bus operations and the land-use development in Hong Kong.

The history of MTR in Hong Kong dates back to 1965. At that time, the Colonial Government published a report 'Hong Kong passenger transport survey', which suggested the use of rail transport. This led to the setting up of the MTR Corporation (MTRC) in 1975. In early days, the MTRC was a Government-owned body. However, in 2000, it was privatized as a listed company. In 2007, MTRC merged with KCRC as the sole railway operator in Hong Kong.

Since its operation, MTR has been a keen competitor against buses. This is exaggerated by the town planning prospect of Hong Kong, where most of the development is concentrated in small urban districts. The routes of the MTR go along the busiest areas of Hong Kong (see Appendix 5), which comprise the major demand for public transport. Because of high usage, these services enjoyed low average cost (shared by passengers) (Coase 1946: 178). This generates a keen completion in the most 'profitable' routes which were formerly monopolized by bus companies. Some bus routes, for example, the North-Island routes and the Nathan Road routes, even run in parallel with the MTR after the commencement of MTR.

Over the past years, the Government has offered a number of protective mechanisms and financial initiatives for the MTR to improve its services and encourage capital investment. The most significant aspect is the development rights above their stations, which now occupies a major portion (66.9% in 2009[10]) of their profits. In 2009, the MTRC catered for 39.4% of total public transport journeys in Hong Kong (Transport Dept. Jan. 2010: s5), which is higher than the sum of all franchised bus companies in Hong Kong.

Route maps of the initial and current MTR system are included in Appendix 5.

3. Announcement Report, Annual Results 2009, MTRC, p.25

CHAPTER 3

HYPOTHESES

Having studied the franchising framework and the history of bus operation with reference to Coasian theories, we develop three empirical hypotheses in this dissertation based on Coase's theories of firms and public utilities. In the following session, numerical analyses are taken to investigate the performance of the two largest bus companies, Kowloon Motor Bus (KMB) and China Motor Bus (CMB) in greater detail. The three hypotheses are listed below:

Hypothesis 1

"Economies of scale can be achieved in the bus operation of Hong Kong."

This hypothesis is developed from the findings of similar researches in foreign countries. Obeng (1985) suggested that urban bus systems in the US displayed positive economies of scale (Obeng 1985: 2). Similar conclusions were also drawn in Viton (1981) and Berechman (1983) for Israel. Therefore, in later chapters, we will investigate whether this statement is viable in Hong Kong.

Hypothesis 2

"The involvement of real-estate business by bus companies generates a negative impact in the allocation of resources."

This hypothesis is based on the assumption in Coase (1937). In the paper, it stated that conglomerate firms have a higher tendency for mismanagement over individual productions. Later analysis will consider whether this prediction takes place in the bus industry of Hong Kong, with the use of production models.

Hypothesis 3

"The impact of MTR poses a positive impact in the production efficiency for resource allocation."

It is widely acknowledged in micro-economics that the presence of competition poses efficiency-seeking effects. Firms are driven to improve their services (so as to attract more customers) and promote better allocation of production resources to deal with competition (Gwilliam et al. 1985: 107; Yarrow 1986: 13). The applicability of this statement to the Hong Kong Bus Sector will be tested in later chapters.

In Hong Kong, the MTR has long been treated as the major competitor against buses. This is mainly due to the geographical intensity of development. Also, there is also the belief that after MTR starts operation, bus companies can reduce their expenses on some routes and concentrate more on providing subsidiary transport services, such as the Feeder Bus services (Transport Department 1989: s8(4)).

Hypothesis 4

"The presence of other transport modes poses a positive impact in the production efficiency."

This hypothesis is similar to hypothesis 3 regarding the effect of competition. Here, two other transport modes, Public Light Buses (PLBs) and the Light Rail Transit (LRT) System will be examined.

Remarks

In this dissertation, only the two largest companies in Hong Kong, KMB and CMB, are chosen to define our scope of study. Operational data for other bus companies (CTB, NWFB and NLB) are excluded. However, a table showing the operating information of all bus companies is included in Appendix 4 to assist further studies.

CHAPTER 4

METHODOLOGY

This chapter explains the choice of economic model, model specifications and the key assumptions behind running the model.

Choice of economic model

In this current study of transport companies, two production models, 'translog' production model and a more restrictive Cobb-Douglas model, are chosen to investigate the operation of public transit companies. The previous 'translog' model was introduced in Christensen et al. (1971), and was initially designated for the manufacturing industry. This paper adopts a rather 'localized' version as described in Berechman (1983) and Obeng (1985), which specifically adjust this model to fit in the scenario of bus operations. This translog production model has an advantage over linear models in Coles and Wabe (1975) and traditional Cobb-Douglas models in Williams (1979) in capturing cross-substitution effects between different forms of inputs, which is usual in the public transport sector (Viton 1981: 288).

In previous chapters, it mentioned various alternate production models for scale analysis. However upon further investigations, some of them cannot be adopted in this study. One limitation is the lack of comprehensive samples we perceive in Hong Kong. Here, local transport services have been historically provided by private limited enterprises, which in most cases, will be reluctant to disclose their operational details except in annual reports. This generates problems in the availability of data compared to other cities such as the U.S. and U.K., where public transport is provided by public subsidiaries (Coles and Wabe 1975: 128; Williams 1979: 214). This lack of comprehensive and precise operational data is equally faced by public agencies, who expressed their difficulties in carrying out transport-policy researches (Smith and associates 1976: 39). This lack of information prohibits the use of C.E.S. production function and the more advanced 'flexible' models.

Third, adopting a translog production model offers better samples for benchmarking, thus assists future comparisons with other countries. As mentioned before, Translog production function is widely used for transport analysis, especially in bus-related studies (Button and Hensher 2000: 330). Therefore, the result generated from this paper can act as a foundation to facilitate further studies in scale economics.

Despite the advantages of the translog model, the major limitation of the model is the requirement of large sample size to estimate its large number of coefficients. As comprehensive operational data was only reported in annual terms, every run of this model will inevitability incorporate a long study period. This rules out the idea to estimate separate models for shorter periods. To deal with this problem, after running the translog model, operational data will be extracted and re-processed in a more restrictive model. In this new model, all cross-substitution effects were assumed unity (so that it becomes a purely Cobb-Douglas model). This model significantly reduces the sample size requirement, and allows calculation of scale factors in each segment period.

As mentioned previously, Cobb-Douglas production function ignores cross-substitution effects. In this current study, we limit our studies to scale-effects and eventual analysis. It can therefore reasonably exclude the cross-effects of inputs.

Assumptions in the analysis

Upon using the translog and Cobb-Douglas model for transport studies, we have to make some assumptions as follows:

1. *The target company is a 'pure' transport company*

   This suggests that all the revenues and cost engaged in the economic model are fully attributed to transport operation. (Berechman 1983: 4; Filippini and Prioni 2003: 3)

2. *The amount of services provided by the transport company is mainly determined by labour, capital and energy* (Obeng 1985: 2)

Model Specification

<u>Part 1 – The Translog Model</u>

Based on the assumptions made above, we assume that the production is a function of fuel, labour and capital (Berechman 1983: 10; Obeng 1985: 184), which is shown as follows:

$$Q = f\,(k, e, l), \tag{1}$$

where Q = Output measured in total passenger-journeys
k = Capital Input
E = Energy Input
L = labour Employed

Assume that the total production cost of a public transit company is a function of unit input prices and output. We obtain the cost function as follows:

$$C = g\,(p_i, Q), \tag{2}$$

where C = Total Production Cost
p_i = Unit price of all factor inputs
Q = Total Unit of Production

Combining Equation (1) and (2), the cost function of a transport company can therefore be written as:

$$C = g\,(Q, p_K, p_E, p_L), \tag{3}$$

where Q represents the quantity of production; p_K, p_E, p_L represents the respective unit cost for capital, fuel and workers

(Obeng 1985:184; Flippini 2003: 686)

For the cost variables, it is important to note that all samples in the regression model should be deflated to the same price level. This is to diminish the effect of changing the aggregate price level on the production costs. In this regard, all costs (p_K, p_E, p_L) were divided by the GDP deflator (d) to get the real value.

In this study, we aim to investigate the impact of various factors in the total cost of production. Therefore, three extra factors, 'technology' (t), 'competitor' (M), and 'Events' (E) are added to the production function. The meanings of these factors are shown as follows:

Technology (t)

This technology indicator is a continuous variable added to account for technology advancement throughout the study period. As time passes, there should be technology change and invention over time, which assist the production of operators. In this current study, we assume a constant rate of advancement for simplicity. That is, a '1' is added to this variable every year, and '0.5' for every half year (Entry for 1950 is taken initially as '1'). In some studies, such as Berechman (1983) and Obeng (1985), this technology factor is missed out. This is probably because of the short time intervals of their studies, which assumes negligible technology change. As for our case, a long study period is incorporated. This variable should not be ignored.

Competitor (M)

The dummy variable ‘Competitor’ (M) is added to represent the existence of competitors. Competitors, as mentioned above, may boost the production efficiency (reduce production cost) or exerts extra production costs to operators.

<u>Other variables</u>

Besides the above variables, various ‘event’ dummies are also included in the analysis. This is to assist our study of different events mentioned in Ch.3. The variables used in this study will be discussed in ‘data description’.

In the translog analysis of Filippini and Prioni (2003), a variable ‘ownership’ was incorporated. This is used to study the effect of privatization in bus operations. During their study period, the target bus companies were re-structured from a Government subsidiary to a private enterprise. In our analysis, there are no such observations during the study period (1950-2009). All the companies remain private limited enterprises throughout the time.

After adjusting the variables in equation (3), we obtain the following production function:

$$C = g\,(Q, p_K, p_E, p_L, t, M_i, E_j), \qquad (4)$$

where all the variables bear the same meaning as above

Rewriting Equation (4) using the translog production function demonstrated in Christensen *et al* (1971) and Berechman (1983), and upon adjustment for dummy variables, the general cost function of a public transport company can be shown as:

$$\begin{aligned} \ln C = {} & \alpha_0 + \alpha_Q \ln Q + \alpha_K \ln p_K + \alpha_E \ln p_E + \alpha_L \ln P_L + \alpha_{QQ} (\ln Q)^2 / 2 + \\ & \alpha_{QK} \ln Q \ln p_k + \alpha_{QE} \ln Q \ln p_E + \alpha_{QL} \ln Q \ln p_L + \alpha_{KK} (\ln p_K)^2 / \\ & 2 + \alpha_{KE} \ln P_K \ln p_E + \alpha_{KL} \ln p_K \ln p_L + \alpha_{EE} (\ln p_E)^2 / 2 + \\ & \alpha_{EL} \ln p_E \ln p_L + \alpha_{LL} (\ln p_L)^2 / 2 + \alpha_i M_i + \alpha_i E_j \qquad (5) \end{aligned}$$

As mentioned above, economies of scale is a measure of scale effects in production. It is regarded as the change in average production cost with an increase in unit output (Berechman 1983: 10; Obeng 1983: 186). In mathematics, it can be expressed by '$\frac{\delta \ln AC}{\delta \ln Q}$'.

To include the component of average cost in this model, some terms have to be rearranged. It is known that the average cost, AC, is defined as total production cost per quantity produced, which is written as:

$$C = AC \times Q$$

By taking the logarithm of both sides, we obtain the following equation:

$$\ln C = \ln AC + \ln Q$$

Differentiating the above equation with respect to ln Q, we obtain:

$$\frac{\delta \ln C}{\delta \ln Q} = \frac{\delta \ln AC}{\delta \ln Q} + 1 \text{; or}$$

$$\frac{\delta \ln AC}{\delta \ln Q} = \frac{\delta \ln C}{\delta \ln Q} - 1 \qquad (6)$$

The term $\frac{\delta \ln C}{\delta \ln Q}$ in the above equation can be obtained by differentiating Equation (5), which follows that:

$$\frac{\delta \ln C}{\delta \ln Q} = \alpha_Q + \alpha_{QQ} \cdot \ln Q + \alpha_{QK} \cdot \ln p_K + \alpha_{QE} \cdot \ln p_E + \alpha_{QL} \cdot \ln p_L$$

Substituting the above equation in (6), it gives rise to the equation below:

$$\frac{\delta \ln AC}{\delta \ln Q} = \alpha_Q + \alpha_{QQ} \cdot \ln Q + \alpha_{QK} \cdot \ln p_K + \alpha_{QE} \cdot \ln p_E + \alpha_{QL} \cdot \ln p_L - 1 \quad (7)$$

The above value, $\frac{\delta \ln AC}{\delta \ln Q}$, is also called the cost elasticity of output (Berechman 1983: 4), or average cost elasticity (ECS), (Obeng 1985: 4). This value of ECS has a strong implication in scale economics as shown below:

Table 4.1 Implication of ECS

Value of ECS	Implication
< 0 (Negative)	Economies of Scale
= 0	Constant Returns to Scale
> 0 (Positive)	Diseconomies of Scale

In this model, a number of coefficients are generated. They can be used to estimate the factor substitution and factor productivity of each input factor (i.e. Energy, Labour and Capital). But this is not the main theme of this dissertation and therefore is not discussed here.

Part 2 – The Cobb Douglas Function

As mentioned previously, the Cobb-Douglas production function is a restricted form of the translog production equation. In this dissertation, this function is used to supplement the previous translog production model to shorten each period of analysis. This allows separate sets of coefficients to be estimated in each period, and therefore estimates the extent of scale economies in each subsidiary period.

Ignoring all the cross-relationships of inputs in Equation (5) above, we rewrite the production equation as follows:

$$\ln(TC) = \beta_0 + \beta_Q \cdot \ln Q + \beta_K \cdot \ln p_K + \beta_E \cdot \ln p_E + \beta_L \cdot \ln p_L + \beta_t \cdot t + \beta_i \cdot M_i + \beta_j \cdot E_j \,, \tag{8}$$

where β_0, β_Q, β_K, β_E, β_L, β_t, β_i, β_j are coefficients to be estimated; Q is the output expressed in total passenger-journeys;
p_K, p_E and p_L are respective unit costs for capital, energy and labour; t indicates the technology advancement; M_i represent competitors; and E_j are event dummies.

The definitions of terms in this equation are in line with equation (5). And we adopt the same values in part 1 for each variable in this current model.

The above Equation (4) is also a typical cost function under Cobb-Douglas production model. This logarithmic form is generally adopted by researchers to estimate different production coefficients. (Wiliams 1979: 215)

Differentiating the equation (4) above with respect to Q, we obtain the coefficient β_Q. And from Equation (2), we obtain:

$$ECS = \frac{\delta \ln AC}{\delta \ln Q} = \frac{\delta \ln C}{\delta \ln Q} - 1 = \beta_Q - 1$$

The subsequent processing of data is similar to that of the translog production model mentioned in part A.

In this subsequent Cobb-Douglas Model, a time-break was inserted in 1972 to split the investigation period, which gives rise to two separate models from 1950 to 1998. This is mainly due to two reasons. First, the commencement of cross-harbour routes in August 1972 marked a new era in the operating environment for bus companies. With these new routes granted, both companies (CMB and KMB) were able to take in passengers from both sides of the harbour. This leads to a substantial change in the service network of their bus services. Also, a new operational arrangement of bus routes was initiated behind the cross-harbour routes. Individual bus companies operated these routes on a joint-mileage basis, and reaped their shares of profit. (Annual Report 1973) This posed a significant change in the operating tactics of bus companies.

Second, splitting the model in 1972 allows more accurate estimation in the coefficients. By doing so, our effort in determining the coefficient of 'tunnel' can be saved, since this factor is not our main focus in this dissertation. This increases our sample size and hence number of coefficients.

Data Description and Processing

In the following analysis, focus is put onto the two largest bus companies, China Motor Bus (CMB) and Kowloon Motor Bus (KMB). For each company, variables mentioned in Equation (1) were collected. Each of them bears a specific meaning as demonstrated in Berechman (1983); Obeng (1985); and Filippini and Prioni (2003). These data were then plugged into the 'translog' production function mentioned in (1) for regression. Details of each variable are summarized in table 4.2 below:

Table 4.2 Definitions of each variable in production model

Variable	Abbreviation	Description
Total Cost	C	- Operating Cost for transport
Output	Q	- Passenger-Journeys carried
Unit Cost of Capital	p_K	- Cost for land, Spare parts, Insurance, Maintenance and other intangible assets (per bus)
Unit Cost of Energy	p_E	- Fuel, Oil and Petrol Cost (per operating kilometre)
Unit Cost of Labour	p_L	- Provision for salaries and wages and other welfare to staff (per employee)
Competitors	M	- Effect of competitor - Dummy variables (0/1)
Events	E	- Effect of Cross-harbour Tunnel - Engagement in real estate activities - Dummy variables (0/1)

In the above table, it is important to note that all entries for ‘costs’ includes only the operating cost, which are essential for ordinary transport activities. The amounts for capital investment and non-bus operations, for example, advertising and bus hiring costs, are excluded from the regression data.

Variable ‘Competition’ and ‘Event’ are dummy variables which are given the number 0 or 1. For the variable ‘Competition’ (M), it accounts for the occurrence of a competitor. When a new competitor is introduced, ‘1’ is given.

In this model, three modes of competitors, the Mass Transit Railway (MTR), Public Light Buses (PLBs) and Light Rail Transit LRT are included. MTR takes the value ‘1’ since 1979, when the modified initial system was opened. PLB takes the value ‘1’ since 1969, when initial licences were granted to legalize the PLBs in Hong Kong (Wong 2001: 19). LRT takes the value ‘1’ since 1989, following the commencement of the LRT system in the New Territories.

The provision for MTR and PLB was incorporated in both production model of KMB and CMB, since actual overlapping of services was noted between these transport modes. However, the provision for LRT is only included in the model of KMB. This is because the service network of LRT is restricted to the North-western part of the New Territories, and therefore should serve limited influence to CMB in the Hong Kong Island.

Variable ‘Event’ is another dummy variable in this model. In our current analysis, two factors, ‘TUNNEL’ and ‘DEV’ are incorporated in this variable. Variable ‘TUNNEL’ only occurs in the more advanced ‘translog’ model. In the revisited Cobb-Douglas Model, this variable can be omitted since a time-break is set to split the investigation period (see P. 43). This variable takes the value of ‘1’ since 1972, when cross-harbour routes were introduced. This event placed a high impact in the operating culture of both KMB and CMB as mentioned previously, and therefore cannot be neglected.

Variable ‘DEV’ accounts for the involvement in real estate activities by bus companies. In our case, a direct involvement in real estate development activities by that company is counted. That is, the company directly undertakes to make decisions on land developments not relating to transport operations. Therefore, under this definition, earnings through selling land to a third party, or indirect participation through equity investment, are not counted. A company is given ‘1’ for this variable when it is directly engaged with property development projects. This variable represents any change in resource allocation upon becoming a conglomerate firm.

For CMB, this value is taken as ‘1’ since 1987. Since that year, CMB initiated their real estate business in the redevelopment of two sites, IL5532 and IL7178 (later combined as IL8849), in North Point as a residential and commercial complex, which were formerly used as bus depots. This is stated in the Annual Report as follows:

"The question of redeveloping of Inland Lot 5532 and Inland Lot 7178 is under active consideration... An application was made under Section 16 of the Town Planning Ordinance (Cap.131) to the Town Planning Board to redevelop these sites into residential, office and retail complexes. The Broad of Directors has not yet decided..."
(Annual Report of CMB 1987: 6)

At present, the site is used as a residential and commercial complex, Island Place, which comprises a shopping centre, residential units and an office tower. The current situation of this site is shown in the photograph below:

Figure 4.1 Island Place, an ex-depot of CMB
(Photograph taken on 30/3/2010)

KMB takes this value '1' under this definition much later, in

2003. In that year, the Lai Chi Kok Properties Investment Ltd. (LCKPI), a fully-owned subsidiary of KMB Holdings Ltd. was founded. The company was to undertake the residential and commercial development of the former Lai Chi Kok Depot. Details of the project are described in its Annual Report 2003.

"LCKPI, a wholly owned subsidiary of the Group, is the owner of the old depot site at Po Lun Street, Lai Chi Kok. The depot ceased operations in 2002 and was demolished in the same year. The site is being redeveloped into a residential and commercial complex with a total gross floor area of about one million square feet and a retail podium area of about 50,000 square feet."
(Annual Report of KMB 2003: 41)

At present, the site has been developed as a residential and commercial complex, Manhattan Hill. Current status of the site is shown in the following photo:

Figure 4.2 The Manhattan Hill, an ex-depot of KMB
(Photograph taken on 28/3/2010)

Lastly, for the deflator used to acquire real prices, GDP deflators for the corresponding periods are recorded. In economic studies, researchers mainly use GDP deflator and Consumer Price Index (CPI) to adjust for price movements. In our case, GDP is used as it serves as a more comprehensive indicator for the whole economy.

Official accounts for GDP deflator since 1961 was launched by the Statistical Department. Before 1961, no such figure is officially published to public. However, there exist a brief estimation of this deflator based on wage index, fuel index and retail price index, by the Government, which could be achieved in the public records. These figures were used as deflators over our study period. The values of these are attached in Appendix 3.

In this dissertation, operational data for the above entries are recorded, from the year 1950 to 2009. For the years 1950 to 1998, annual operation statistics are taken. For the years 1998 to 2009, semi-annual data are used. This is to provide enough 'population' for the last 11 years to run a fair translog model (at least 20 sets of data are necessary for a sound result).

Data before 1950 are ignored in this current study. This is due to the outbreak of the Pacific War, which brought massive destruction of Government records. Statistical data on bus operations before 1941 were destroyed during the war (HKRS170-1-739-1/PRO; Davis 1995: 1). During 1941-1945 of the Japanese occupation, bus operations in Hong Kong were halted, and therefore no operational data can be drawn (Davis 1995: 19; HKRS170-1-730/PRO; Chan 1999: 19).

Bus services in Hong Kong resumed, in September 1946 (for KMB) and November 1946 (for CMB). However, our first record in this study is taken in 1950. This is because bus companies were undertaking a revitalization stage from the Second World War (WWII) before 1950, in which massive destruction of their fleets and assets were caused. This can be shown as follows:

"The Japanese had confiscated almost all the buses and stocks of spare parts and few can be traced. ... When the relieving forces came ashore in 1945 they found little serviceable road transport."
(Hong Kong Annual Report, 1946, p. 90)

Similar facts are recorded in Davis (1995). It mentioned that a considerable amount of resources had to be spent by both companies to resume their services (Davis 1994: 14, 17), which boosted the operational cost. Bus services were not rehabilitated until 1949 (Ng 1950: 2-14). Therefore, to give a fair result, our analysis excludes operational data before 1950.

Besides that, operating statistics for 1967 are rejected as well. This is due to the uncertain political condition and massive social disorder that occurred throughout that year, which adversely affected the provision of public transport (Ng 1968: 87; Chan 1999: 32). This interruption of services was recorded in offically as follows:

"The Kowloon Motor Bus Company had to suspend services on many routes and carried out a re-examination of the justification and requirements of each route before bringing them back into operation. ... China Motor Bus Company was operating 77 per cent of normal services and the Kowloon Motor Bus 75 per cent" (Hong Kong Annual Report 1967, p. 190-191)

Similar evidence on the severe impact is also displayed in a significant drop in mileage and ridership (shown in Appendix 4) during that year.

As regards the 'cost' and passengers in the regression model, the KMB data includes operating details of both KMB and LWB after 1997. In Yang (2009), data for LWB was treated in a separate model. However, upon further analysis, it is revealed that LWB depends largely on its mother company, KMB, in its operation. Many production resources, such as its head office and managers, are shared among the two companies (KMB 2000: 58, 94). Therefore, identifying LWB as a separate enterprise will produce a biased result and underestimate its operating cost.

The collected data are then processed with a statistical software 'E-Views 5.1'. In the program, coefficients are estimated using the common 'Least Square' method. A 'best-fit' line linking all the independent variables is estimated upon the running the model.

Sources of data

All the data used in this study are first-hand data disclosed by the authority or relevant companies. All data on operating costs, which include Labour Cost, Capital Cost and Fuel Cost, are extracted from two sources. Data from 1950-1975 are adapted from original Government documents on the companies' financial accounts, which bus companies are required to disclose periodically under section 10 (CMB) or section 9 (KMB) of the franchise terms. This information is available at the Hong Kong Public Records Office (PRO). Data after 1975 are extracted from annual and interim reports published by the relevant companies. This is attributed to the confidentiality of these operational data until 2013.

Details about the mileage (measured in kilometres) and ridership (measured in passenger-journeys) from year 1950 to 1971 are adapted from the Annual Reports of Hong Kong, and relevant traffic statistics obtained from the Transport Department.

Data on GDP deflator is adapted from two sources. Data after 1961 can be accessed in annual reports of Hong Kong. Before 1961, no precise value could be traced. However, there are certain estimates that were performed within Government Departments based on three indexes, retail price index, wage index and fuel index. These unpublished data could be traced from the public records.

CHAPTER 5

EMPIRICAL FINDINGS

Following the methodology mentioned above, we divide our timeline into two periods. The first period, 1950 to 1998, adopts annual operational information. The more recent set, 1998 to 2009, adopts semi-annual data instead. This is due the small sample size throughout the last 11 years, which therefore prohibits the use of annual operational data. Model 1 to 3 adopts a more advanced translog model. Model 4 to 8 are revisited models using a more simplified Cobb-Douglas Function, which aims to solve for fragmented periods as mentioned in the previous chapter. Regression results of each model are shown as follows:

Model 1: C.M.B. (1950-1998) (Annual Data used)

Dependent Variable: LOG(TC)
Method: Least Squares
Date: 04/04/10 Time: 12:15
Sample: 1950 1998
Included observations: 48
LOG(TC) = C(1) + C(2) * LOG(PASS) + C(3) * LOG(PK) + C(4) * LOG(PE) + C(5) * LOG(PL) + C(6) / 2 * (LOG(PASS)^2) + C(7) * LOG(PASS) * LOG(PK) + C(8) * LOG(PASS) * LOG(PE) + C(9) * LOG(PASS) * LOG(PL) + C(10) / 2 * (LOG(PK)^2) + C(11) * LOG(PK) * LOG(PE) + C(12) * LOG(PK) * LOG(PL) + C(13) / 2 * (LOG(PE)^2) + C(14) * LOG(PE) * LOG(PL) + C(15) / 2 * (LOG(PL)^2) + C(16) * T + C(17) * PLB + C(18) * MTR + C(19) * TUNNEL + C(20) * DEV

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-36.05431	24.08015	-1.497263	0.1455
C(2)	0.117261	1.582398	0.074104	0.9415
C(3)	3.595535	1.287568	2.792501	0.0093
C(4)	0.681109	2.870634	0.237268	0.8142
C(5)	4.405939	1.832281	2.404620	0.0230
C(6)	0.212167	0.092744	2.287659	0.0299
C(7)	-0.069403	0.055157	-1.258293	0.2187
C(8)	0.144926	0.070291	2.061815	0.0486
C(9)	-0.240244	0.097801	-2.456450	0.0205
C(10)	-0.013027	0.082413	-0.158075	0.8755
C(11)	-0.054616	0.081599	-0.669329	0.5088
C(12)	-0.178487	0.108088	-1.651314	0.1098
C(13)	-0.572393	0.176202	-3.248512	0.0030
C(14)	-0.193620	0.167999	-1.152508	0.2589
C(15)	0.219665	0.156191	1.406391	0.1706

C(16)	0.016400	0.004335	3.783393	0.0007
C(17)	-0.086870	0.048176	-1.803190	0.0821
C(18)	-0.011745	0.084027	-0.139777	0.8898
C(19)	-0.003739	0.057139	-0.065435	0.9483
C(20)	0.500297	0.115745	3.322396	0.0012

R-squared	0.998138	Mean dependent var	19.47256
Adjusted R-squared	0.996875	S.D. dependent var	0.718808
S.E. of regression	0.040186	Akaike info criterion	-3.296277
Sum squared resid	0.045217	Schwarz criterion	-2.516610
Log likelihood	99.11065	Durbin-Watson stat	2.065649

Model 2: K.M.B. (1950-1998) (Annual Data used):

Dependent Variable: LOG(TC)
Method: Least Squares
Date: 04/04/10 Time: 10:43
Sample: 1950 1998
Included observations: 48
LOG(TC) = C(1) + C(2) * LOG(PASS) + C(3) * LOG(PK) + C(4) * LOG(PE) + C(5) * LOG(PL) + C(6) / 2 * (LOG(PASS)^2) + C(7) * LOG(PASS) * LOG(PK) + C(8) * LOG(PASS) * LOG(PE) + C(9) * LOG(PASS) * LOG(PL) + C(10) / 2 * (LOG(PK)^2) + C(11) * LOG(PK) * LOG(PE) + C(12) * LOG(PK) * LOG(PL) + C(13) / 2 * (LOG(PE)^2) + C(14) * LOG(PE) * LOG(PL) + C(15) / 2 * (LOG(PL)^2) + C(16) * T + C(17) * PLB + C(18) * MTR + C(19) * LRT + C(20) * TUNNEL

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-61.01727	60.46309	-1.009166	0.3215
C(2)	4.660191	3.392447	1.373696	0.1804
C(3)	-9.168363	3.747882	-2.446279	0.0210
C(4)	9.737150	3.886473	2.505395	0.0183
C(5)	13.02052	6.926439	1.879829	0.0706
C(6)	-0.102394	0.101417	-1.009638	0.3213
C(7)	0.271677	0.067785	4.007927	0.0004
C(8)	-0.228703	0.132027	-1.732242	0.0942
C(9)	-0.442055	0.268043	-1.649197	0.1103
C(10)	0.189558	0.060949	3.110110	0.0043
C(11)	0.264292	0.143773	1.838262	0.0767
C(12)	0.130786	0.234829	0.556944	0.5820
C(13)	-0.335703	0.183732	-1.827129	0.0784
C(14)	-0.670785	0.277516	-2.417101	0.0224

C(15)	-0.414770	0.352475	-1.176736	0.2492
C(16)	0.044582	0.007198	6.193910	0.0000
C(17)	0.036364	0.099814	0.364315	0.7184
C(18)	-0.067707	0.038208	-1.772067	0.0873
C(19)	0.000757	0.043930	0.017243	0.9864
C(20)	-0.288593	0.158718	-1.818281	0.0797

R-squared	0.999092	Mean dependent var	20.71467
Adjusted R-squared	0.998475	S.D. dependent var	0.852730
S.E. of regression	0.033298	Akaike info criterion	-3.672277
Sum squared resid	0.031046	Schwarz criterion	-2.892610
Log likelihood	108.1346	Durbin-Watson stat	1.762444

Model 3: K.M.B. (1998-2009) (Semi-Annual Data used):

Dependent Variable: LOG(TC)
Method: Least Squares
Date: 04/04/10 Time: 13:00
Sample: 1998S1 2009S2
Included observations: 24
LOG(TC) = C(1) + C(2) * LOG(PASS) + C(3) * LOG(PK) + C(4) * LOG(PE) + C(5) * LOG(PL) + C(6) / 2 * (LOG(PASS)^2) + C(7) * LOG(PASS) * LOG(PK) + C(8) * LOG(PASS) * LOG(PE) + C(9) * LOG(PASS) * LOG(PL) + C(10) / 2 * (LOG(PK)^2) + C(11) * LOG(PK) * LOG(PE) + C(12) * LOG(PK) * LOG(PL) + C(13) / 2 * (LOG(PE)^2) + C(14) * LOG(PE) * LOG(PL) + C(15) / 2 * (LOG(PL)^2) + C(16) * T + C(17) * DEV

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-1626.238	2748.533	-0.591675	0.5727
C(2)	180.3283	276.9616	0.651095	0.5358
C(3)	54.70035	69.48603	0.787214	0.4570
C(4)	3.901664	38.78187	0.100605	0.9227
C(5)	-83.99886	89.01886	-0.943608	0.3768
C(6)	-10.08028	14.05203	-0.717354	0.4964
C(7)	-2.551696	3.993027	-0.639038	0.5431
C(8)	-0.060690	1.907253	-0.031821	0.9755
C(9)	4.473347	5.388658	0.830141	0.4339
C(10)	0.144621	1.697873	0.085178	0.9345
C(11)	-0.031761	1.014355	-0.031312	0.9759
C(12)	-0.418260	1.962758	-0.213098	0.8373
C(13)	0.187947	0.488928	0.384406	0.7121

C(14)	-0.197588	1.282067	-0.154117	0.8819
C(15)	-0.033088	4.256561	-0.007773	0.9940
C(16)	-0.005667	0.005792	-0.978513	0.3604
C(17)	0.021794	0.035702	0.610436	0.5609

R-squared	0.994845	Mean dependent var	21.57983
Adjusted R-squared	0.983061	S.D. dependent var	0.156493
S.E. of regression	0.020368	Akaike info criterion	-4.765207
Sum squared resid	0.002904	Schwarz criterion	-3.930752
Log likelihood	74.18249	Durbin-Watson stat	2.374971

Model 4: C.M.B. (1950-1971) (Annual Data used):

Dependent Variable: LOG(TC)
Method: Least Squares
Date: 04/04/10 Time: 15:21
Sample: 1950 1971
Included observations: 21
LOG(TC) = C(1) + C(2) * LOG(PASS) + C(3) * LOG(PK) + C(4) * LOG(PE) + C(5) * LOG(PL) + C(6) * T + C(7) * PLB

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-1.981235	1.459359	-1.357606	0.1961
C(2)	0.664514	0.089680	7.409852	0.0000
C(3)	0.155617	0.040632	3.829912	0.0018
C(4)	0.152199	0.064635	2.354745	0.0337
C(5)	0.587437	0.057127	10.28301	0.0000
C(6)	0.016008	0.008697	1.840596	0.0870
C(7)	-0.048531	0.044708	-1.085514	0.2960

R-squared	0.997786	Mean dependent var	18.81145
Adjusted R-squared	0.996838	S.D. dependent var	0.494599
S.E. of regression	0.027813	Akaike info criterion	-4.065405
Sum squared resid	0.010830	Schwarz criterion	-3.717230
Log likelihood	49.68675	Durbin-Watson stat	1.074549

Model 5: C.M.B. (1972-1998) (Annual Data used):

Dependent Variable: LOG(TC)
Method: Least Squares
Date: 04/04/10 Time: 16:40
Sample: 1972 1998
Included observations: 27
LOG(TC) = C(1) + C(2) * LOG(PASS) + C(3) * LOG(PK) + C(4) * LOG(PE) + C(5) * LOG(PL) + C(6) * T + C(7) * MTR + C(8) * DEV

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	1.197842	1.659182	0.721947	0.4791
C(2)	0.577117	0.052786	10.93321	0.0000
C(3)	0.064086	0.080883	0.792339	0.4379
C(4)	0.429451	0.119046	3.607451	0.0019
C(5)	0.474022	0.067867	6.984609	0.0000
C(6)	0.030326	0.004905	6.183371	0.0000
C(7)	-0.000183	0.096843	-0.001891	0.9985
C(8)	0.189790	0.078515	2.417233	0.0259

R-squared	0.980660	Mean dependent var	19.95906
Adjusted R-squared	0.973535	S.D. dependent var	0.319514
S.E. of regression	0.051979	Akaike info criterion	-2.834775
Sum squared resid	0.051334	Schwarz criterion	-2.450823
Log likelihood	46.26946	Durbin-Watson stat	2.210314

Model 6: K.M.B. (1950-1971) (Annual Data used)

Dependent Variable: LOG(TC)
Method: Least Squares
Date: 04/04/10 Time: 18:53
Sample: 1950 1971
Included observations: 21
LOG(TC) = C(1) + C(2) * LOG(PASS) + C(3) * LOG(PK) + C(4) * LOG(PE) + C(5) * LOG(PL) + C(6) * T + C(7) * PLB

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	4.830888	2.320531	2.081803	0.0562
C(2)	0.445492	0.109598	4.064789	0.0012
C(3)	-0.028787	0.028597	-1.006637	0.3312
C(4)	0.440462	0.098887	4.454178	0.0005
C(5)	0.478219	0.073319	6.522476	0.0000
C(6)	0.047306	0.009922	4.768004	0.0003
C(7)	0.082324	0.054229	1.518075	0.1513

R-squared	0.997478	Mean dependent var	19.76840
Adjusted R-squared	0.996398	S.D. dependent var	0.581069
S.E. of regression	0.034875	Akaike info criterion	-3.612900
Sum squared resid	0.017028	Schwarz criterion	-3.264726
Log likelihood	44.93545	Durbin-Watson stat	2.647507

Model 7: K.M.B. (1972-1998) (Annual Data used):

Dependent Variable: LOG(TC)
Method: Least Squares
Date: 04/04/10 Time: 17:04
Sample: 1972 1998
Included observations: 27
LOG(TC) = C(1) + C(2) * LOG(PASS) + C(3) * LOG(PK) + C(4) * LOG(PE) + C(5) * LOG(PL) + C(6) * T + C(7) * MTR + C(8) * LRT

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	7.344157	1.828298	4.016937	0.0007
C(2)	0.206875	0.071607	2.889021	0.0094
C(3)	0.294998	0.042049	7.015638	0.0000
C(4)	0.367848	0.093299	3.942667	0.0009
C(5)	0.293860	0.044568	6.593546	0.0000
C(6)	0.071963	0.009145	7.868808	0.0000
C(7)	-0.086530	0.035206	-2.457799	0.0238
C(8)	0.017513	0.035826	0.488843	0.6305

R-squared	0.996860	Mean dependent var	21.33658
Adjusted R-squared	0.995703	S.D. dependent var	0.436024
S.E. of regression	0.028581	Akaike info criterion	-4.030924
Sum squared resid	0.015521	Schwarz criterion	-3.646973
Log likelihood	62.41748	Durbin-Watson stat	2.122811

Model 8: KMB (1998-2009) (Semi-Annual data used):

Dependent Variable: LOG(TC)
Method: Least Squares
Date: 04/04/10 Time: 16:15
Sample: 1998S1 2009S2
Included observations: 24
LOG(TC) = C(1) + C(2) * LOG(PASS) + C(3) * LOG(PK) + C(4) * LOG(PE) + C(5) * LOG(PL) + C(6) * T + C(7) * DEV

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-2.277816	3.140122	-0.725391	0.4781
C(2)	0.741589	0.168458	4.402218	0.0004
C(3)	0.163235	0.055783	2.926229	0.0094
C(4)	0.253281	0.039066	6.483386	0.0000
C(5)	0.591568	0.149183	3.965375	0.0010
C(6)	-0.006899	0.005387	-1.280642	0.2175
C(7)	0.014225	0.022156	0.642022	0.5294

R-squared	0.984248	Mean dependent var	21.57983
Adjusted R-squared	0.978688	S.D. dependent var	0.156493
S.E. of regression	0.022846	Akaike info criterion	-4.481605
Sum squared resid	0.008873	Schwarz criterion	-4.138006
Log likelihood	60.77926	Durbin-Watson stat	2.157230

Economies of scale analysis

Based on the above regression results, we calculate the EOS in various periods from Equation (3). Results are shown as follows:

Table 5.1 Regression results of ECS

Model	Period	Value of ECS Estimated	Bus Operator	Scale Economies
1	1950 – 1998 (excl. 1967)	-0.37054	C.M.B.	Positive
2	1950 – 1998 (excl. 1967)	-0.45296	K.M.B.	Positive
3	1998 – 2009	-0.56299	K.M.B.	Positive
4	1950 – 1971 (excl. 1967)	-0.33549	C.M.B.	Positive
5	1972 – 1998	-0.42288	C.M.B.	Positive
6	1950 – 1971 (excl. 1967)	-0.40362	K.M.B.	Positive
7	1972 – 1998	-0.79313	K.M.B.	Positive
8	1998 – 2009	-0.25841	K.M.B.	Positive

From table 5.1, it is demonstrated that the two big transport companies perceives negative ECS throughout the period, which implies positive returns to scale over the focused period. This is equally proven by the two production models adopted in this investigation. This fulfils the prediction made in Hypothesis 1 regarding scale economies.

For the aspect of competition, three types of competitors (Public light buses, MTR and LRT) are investigated. Their impacts are shown in the coefficients for various dummy variables (PLB, MTR and LRT). Their impacts in mileage and ridership of buses can also be traced from Appendix 4.

Effect of Public Light Buses (PLBs)

The effect of PLBs in bus operation is shown by C(17) of Model 1 (CMB) and Model 2 (KMB); and restated in C(7) of Model 4 (CMB) and Model 6 (KMB). In both Model 1 and Model 4, negative coefficients are reported in the regression model (see C(17) in Model 1; C(7) in Model 4) This shows that the presence of PLBs in the Hong Kong Island prompted CMB to allocate its resources more efficiently. This satisfies part of the initial hypothesis 4 for CMB.

However, for KMB, positive coefficients are reported. It is revealed in C(17) of Model 2 and C(7) of Model 4. This suggests that the presence of minibuses in Kowloon and the New Territories actually boosts the operating cost of KMB. Hypothesis 4 is therefore partly refuted.

Effect of the Mass Transit Railway (MTR)

The cost impact of the MTR in bus operations is demonstrated in C(18) of Model 1 (for CMB) and 2 (for KMB). In our current study, both models report negative values for this factor. This suggests that the presence of the MTR promotes more efficient use of production resources for bus companies, which results in a cost-reduction effect. This result is also coherent with our findings in Model 5 and 7 (see C(7)). This satisfies the initial prediction in Hypothesis 3.

Effect of the Light Rail Transit (LRT)

The impact of the LRT in bus operations is demonstrated in C(19) of Model 2. This factor is not included in the production models of CMB, since the operation of LRT is only limited to the North-western part of the New Territories, which should exert limited effect on the operation of CMB. In our analysis, a positive value is obtained for this variable. The result is supplemented by C(8) of Model 7. This suggests that the introduction of LRT System in late 1988 actually increased the production cost for bus companies. Hypothesis 4 is therefore partly refuted for the case of LRT.

Effect of Real estate business

The result of property development activities in bus operations is displayed in C(20) in Model 1 (for CMB) and C(17) in Model 3 (for KMB). In both cases of CMB and KMB, positive figures are recorded in the production models. This results is supplemented in C(8) in Model 5 and C(7) in Model 8. This implies that the engagement of bus companies in real estate activities has adversely affected their managing efficiency of transport operations. This eventually boosts up the operating cost of transport. Hypothesis 3 is therefore certified.

Data on CTB & NWFB

Analyses on the operation of the CTB and the NWFB were excluded in this study. One reason is the short history of these two companies compared to CMB and KMB, which makes it different to obtain a continuous set of operational data to represent the operating trend. Another reason is the limited availability of operational data. To estimate all the coefficients of a legitimate 'translog' production model, at least 20 sets of data (at least 9 years with semi-annual data) are required. However, operational statistics of these two companies were not fully disclosed by these two companies, which are now under a subsidiary of a private conglomerate enterprise, thereby prohibiting further investigation. More than that, the ownership of these operators kept changing over time, and from a specified bus company to subsidiary branches of public utilities business. Even so, a summary of the available operational data is still included in Appendix 4 for future studies. It is shown that both companies (CTB & NWFB) play a diminishing role in their bus operations, in terms of mileage and their market share.

CHAPTER 6

DISCUSSION OF RESULTS

This chapter discusses some interesting key results as regards the abnormal findings on the impact of the LRT on bus operation; the strange divergence in scale economies and ridership; road planning, town planning and transport policies.

Impact of the LRT on bus operations

From the regression model demonstrated in the previous chapter, it is shown that the operation of the LRT actually increased the operating cost of KMB. This effect is different from the other cases of the PLBs (for CMB) and the MTR. One explanation for this is the additional restriction imposed on bus companies following the commencement of the LRT. In 1988, a new legislation, the Amendment of Franchise (Kowloon Motor Bus Company) Order, was passed on KMB's services. The order, which was effective since 18th September 1988, curtailed the 'internal' bus services within the North-western part of the New Territories as follows:

"..., no bus on any route referred to in the third column of the Schedule opposite that day shall within the North-West Transit Service Area –

(a) put down any passenger who has boarded the bus within the North-west Transit Service Area; or

(b) take up any passenger whose journey is to terminate within the North-west Transit Service Area,

unless permitted by the Commissioner for transport with the consent of the Kowloon Canton Railway Corporation, or in an emergency"

(s3, Amendment of Franchise (Kowloon Motor Bus Company) Order 1987)

With the enforcement of this amendment, the operating region of KMB was further restricted. This may force the company to forfeit one particular market and concentrate on other potentially costly routes with lower ridership. This may contribute to an increasing operating cost for KMB following the operation of the LRT system.

Divergence in ECS and Ridership

Form the above regression result, it is shown that both CMB and KMB enjoy positive economies of scale. However, upon further investigation, it can be observed that this extent of scale benefit actually diminishes since 1970s (i.e. their marginal benefit of 'scale production' diminished). This is shown by a continuous reduction in the value of ECS over time. Moreover, the operating mileage and ridership perceived by both companies are also dropping over time, as shown in Appendix 4. This can be analysed from two aspects, road planning and town planning policies, which is stated as follows.

Road Planning

The operation of bus services is highly dependent on road infrastructure. However, since the late 70s, there have been numerous articles regarding the shortage of road infrastructure, which fails to cater for the demand of road traffic. This lack of road infrastructure affects the ridership and operating costs of the bus companies. This impact was first addressed by CMB in 1978 as follows:

> *"… whilst mileage operated decreased from 26.2 million to 25.8 million due, in the main, to the ever worsening traffic conditions. Without the congestion, the increase in passengers carried would have grown even further."* (Annual Report of CMB 1978, p.9)

KMB also addressed this congestion problem in its Annual Report 1979. It mentioned that:

> *"Traffic Congestion has become a main cause for irregular operation and is responsible for mileage and trip loss. … Financially, traffic congestion has far-reaching effects; slowing down the average speed of buses makes more vehicles necessary in order to move a given number of passengers in a specified time and consequently additional capital investment and operating costs incurred in meeting passenger needs, …"* (Annual Report of KMB 1979, p.6)

Up to the present, traffic congestion still poses a major problem in Hong Kong. Detailed analysis on the economic loss caused by congestion have been widely studied in the academic field, such as Hau (1992); and Lam and Tam (2004). For bus operators, traffic congestion accounted for 34% of total complaints in 2008 (Appendix 4, Transport Complaints Unit Report 2008). One explanation for this wide-spread congestion problem regards the lack of considerations towards transportation in land-use planning, as suggested in Yeh (1996) and Lee (1998). Some researchers argue that the current land-use policies are often used to promote economic development (Yeh 1996: 1), which causes congestion problems on the main roads, (Yeh 1996: 5). One obvious example is the Mid-Levels, which is specifically addressed by the 'Office of The Ombudsman' (OMB) in 2006. Details of their jurisdictions are shown below:

> *"... , the number of residential units in the Mid-Levels has continued to grow, particularly during the period from 1985 to 1996. Eight traffic studies on the Mid-Levels by TD between 1973 and 2005 showed that the traffic condition had never been satisfactory. The Moratorium has clearly failed in its stated objective: the continued building developments and redevelopments have resulted in a rise in the number of residents and volume of traffic in Mid-Levels."*
>
> (Office of the Ombudsman (2006): 75)

This suggests that the existing road infrastructure is unable to cater for the current transport demand derived from its existing land-use.

Town planning policies on transport

Another reason that may lead to a back-drop in bus ridership is the town planning practices nowadays. In recent years, the Government adopted a protective strategy towards railway operations, and places an unfair operating environment for buses (Lau 1997: 148; 2004: 93). This is more obvious in the planning of new towns such as Yuen Long, Tuen Mun and Tseung Kwan O. In Tuen Mun, for example, a monopoly operating right is granted to the LRT system (Details are mentioned previously). A critical analysis in this planning aspect was taken in Lau (1997), on the grounds of depriving reasonable transport choice for residents (Lau 1997: 5).

A similar intention is also observed in Tseung Kwan O. Following the commencement of the Tseung Kwan O Extension of the MTR, a significant number of bus routes were forced to be cancelled to give way to the railways (Lau 2004: 93). This can be attributed to the Government's policy towards MTR as shown below:

"The transport strategy is to place emphasis on rail transport and the co-ordination of public transport services. Priority will be accorded to railways which will form the backbone of our public transport system, and their use will be encouraged."

(Transport Bureau 2002: 2)

Apart from that, the Government's intention to boost the railway sector in public transportation is also mentioned in various planning guidelines. One of these earliest papers is the White Paper published in 1990, which mentioned priorities for railways over buses (Transport Branch of HK 1990: 6). It was later accommodated by the subsequent Railway Development Studies (RDS) (1993; 1999) and Railway Development Strategies (1994; 2000).

In the 'Railway Development Strategy' published by the Government in 1994, it mentioned the use of "route-protection" mechanisms to benefit the railways (Transport Branch 1994: 2), which restrict the operating environment for buses. This was supplemented in its preceding paper in 2000, which aims to boost the market share of the rail sector to 43% in 2016 (Transport Bureau 2000: 12). The third comprehensive transport studies (CTS-3) (1999) also suggested that railways should take over from franchised buses and become the backbone of the whole transport system (Smith, W. and associates 1999: 4).

All these expressed the Government's intention to boost the travel demand of railways over buses, and constitutes a diminishing operating environment for bus companies nowadays.

The following figure shows the proposed railway network of Hong Kong in 2016, as suggested in Railway Development Strategy 2000 (Transport Bureau 2000: 4).

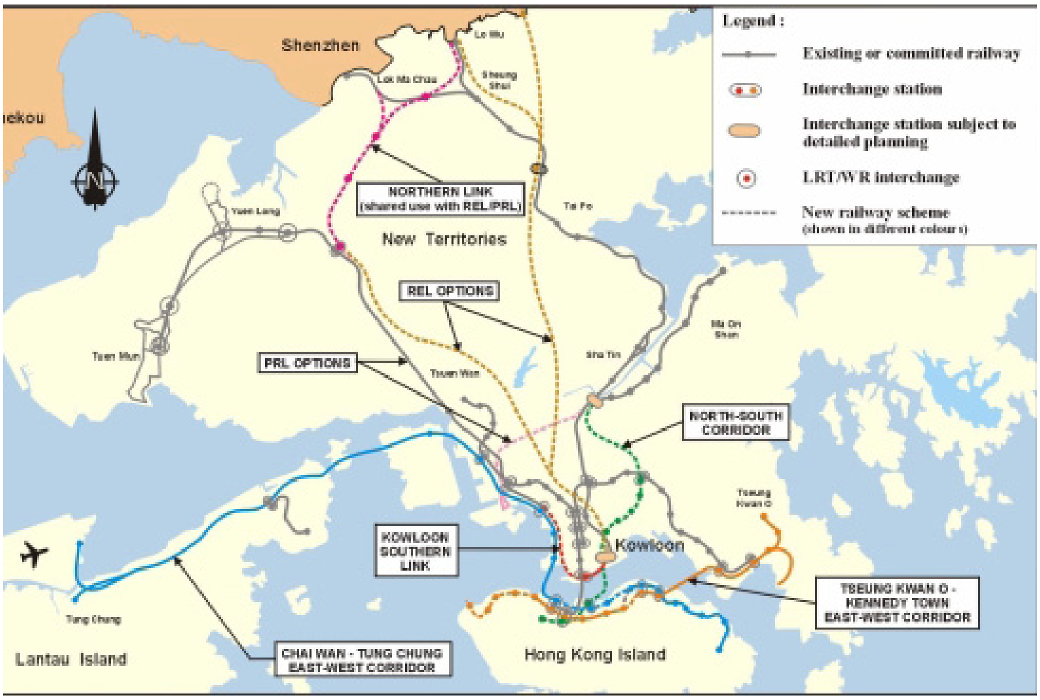


Figure 6.1　Proposed railway network in 2016

CHAPTER 7

CONCLUSION

This dissertation constitutes an original econometric research on the scale economies of public transport in Hong Kong. Past studies on public transport in Hong Kong were mainly on rail. This work is on franchised buses.

The techniques used are Translog regression and Cobb-Douglass Production Function. The data used are verifiable official data and statistics that span from 1950 to 2009 that have been published but have never been used by researchers. Methods developed here can surely be applied to other modes of transport, such as ferries and railways, as well.

Compared to the initial and heroic attempt of Yang 2009, the analysis performed here is far more precise and sophisticated. A more realistic production function is adopted, instead of her linear model, which generates much better information for further studies.

Besides, this dissertation also makes several attempts to interpret transport operations by Coasian concepts and relate them to land-use planning, applying the diverse professional knowledge which I have learnt in the Department of Real Estate and Construction.

Conclusion of this dissertation

This dissertation examines the bus industry in Hong Kong in various aspects: 1) Intention for the Government to safeguard public interest to transport; and 2) the production structure of individual bus companies.

For (1), it is illustrated in various aspects that the franchising framework described in Coase (1959) can be justified in regulating bus operations of Hong Kong. Also, the aim of the Government to provide socially optimal transportation, as described in Coase (1946; 1974) was demonstrated through various control mechanisms.

For (2), it is shown in the 'translog' production model that positive economies of scale are displayed in the two largest bus companies in Hong Kong. This scale efficiency in resource allocation was further boosted with the introduction of competitors. However, their involvement in real estate activities in later years posed negative impacts to bus operations. Finally, it argues that bus operation in Hong Kong is heavily affected by the town planning policies of the Government. Nowadays, a tougher operating environment was placed over bus companies.

Limitation and grounds for further studies

As mentioned in Ch.1 of this dissertation, at present, few attempts have been made by researchers to investigate the scale effects in the Hong Kong bus industry. Although, as stated in Ch.3

that translog production equation has been used widely by researchers, none has been applied to the case in Hong Kong. Therefore, it is believed that the concept and model initiated in this dissertation provides an early base for similar studies in Hong Kong. Also, the use of a common translog model provides favourable result for benchmarking, especially among bus companies from other countries. More than that, in the above regression model, only a narrow part of ‘Economies of Scale’ is studied. Many entries (e.g. factor productivity, cross-substitution of inputs) are still unexplored at present. This dissertation could therefore provide important data for further researches.

There are, however, some limitations in this dissertation as well. To carry out a thorough study of bus transport, it is advisable to carry out investigation into the operation of City-bus (CTB) and New World First Bus (NWFB). However, these analyses were limited by the incomplete operational data disclosed by the company. Since both CTB and NWFB were conglomerated as one enterprise in 2003, operation statistics of individual companies were no longer disclosed. This limited availability of data placed barriers for detailed research.

The ever-changing ownership structure of CTB and NWFB in recent years creates numerous uncertainties for data interpretation. Despite these difficulties, operating data from these two companies were still included in Appendix 4 to assist further studies.

Appendix 1 - Production functions in transport economics

Literature	Type of model used	Location of study	Scope
Kumbhakar (1990)	Generalized McFadden	U.S.A.	Air
Baltagi et al (1995)	Hedonic translog	Canada	Air
Tolofari *et al* (1990)	Translog	U.K.	Air
Williams (1979)	Cobb-Douglas	U.S.A.	Bus
Lee and Steedman (1970)	Linear	U.K.	Bus
Koshal (1972)	Linear	U.S.A.	Bus
Wabe & Cole (1975)	Quadratic	U.K.	Bus
Filippini and Prioni (2003)	Translog	Switzerland	Bus
Berechman (1983)	Translog	Israel	Bus
Viton (1981)	Translog	U.S.A.	Bus
Obeng (1985)	Translog	U.S.A.	Bus
Keeler (1974)	Cobb-Douglas	U.S.A.	Rail
Pozdena and Merewitz (1978)	Cobb-Douglas	U.S.A.	Rail
Hasenkamp (1976)	Constant Elasticity of Substitution	U.S.A.	Rail
De Borger (1992)	Generalized Box-Ox	Belgium	Rail
Bitzan and Wilson (2007)	Hedonic translog	U.S.A.	Rail
Atack (1978)	Linear	U.S.A.	Sea
Case and Lave (1970)	Log-linear	U.S.A.	Sea
Koenker (1972) (Part 1)	Linear	India	Truck

Appendix 2 – History of ordinances regulating bus companies:

Year of enactment	Name of Ordinance	Governing
1912	The Vehicles and Traffic Regulation Ordinance (No. 40)	CMB, KMB
1957	Road Traffic Ordinance (No. 39)	CMB, KMB
1960	Public Transport Service (Hong Kong Island) Ordinance (No. 4)	CMB
1960	Public Transport Service (Kowloon and New Territories) Ordinance (No. 5)	KMB
1975	Public Omnibus Services Ordinance (No. 59)	CMB, KMB, NLB (since 1973)
1984	Public Bus Services Ordinance (Ch. 230)	CMB (to 1998), CTB (since 1992), KMB, NLB, NWFB (since 1998), LWB (since 1996)

Appendix 3 – Deflator used in the regression model

Year / Period	Deflator (2007 = 100)
1950	6.358
1951	6.813
1952	9.084
1953	9.840
1954	9.447
1955	9.014
1956	9.322
1957	9.401
1958	9.178
1959	9.932
1960	9.512
1961	9.200
1961	9.153
1962	9.335
1963	9.687
1964	10.175
1965	10.432
1966	10.493
1967	11.181
1968	11.557
1969	12.203
1970	13.288
1971	14.304
1972	15.623
1973	17.853
1974	19.942
1975	20.872
1976	22.875
1977	23.728
1978	25.623
1979	30.143
1980	34.811
1981	38.384
1982	42.108
1983	44.022
1984	48.270
1985	50.879
1986	52.842
1987	57.442
1988	62.619
1989	70.610
1990	75.904
1991	82.771

(Continued)

Year / Period	Deflator (2007 = 100)
1992	90.986
1993	98.901
1994	105.301
1995	109.650
1996	115.965
1997	122.553
1998	123.664
1998 (1Q)	124.558
1998 (2Q)	122.770
1999	117.825
1999 (1Q)	119.442
1999 (2Q)	116.209
2000	113.198
2000 (1Q)	114.489
2000 (2Q)	111.907
2001	111.531
2001 (1Q)	111.970
2001 (2Q)	111.091
2002	107.348
2002 (1Q)	108.979
2002 (2Q)	105.718
2003	100.615
2003 (1Q)	101.692
2003 (2Q)	99.539
2004	97.334
2004 (1Q)	98.061
2004 (2Q)	96.607
2005	97.663
2005 (1Q)	97.696
2005 (2Q)	97.630
2006	97.746
2006 (1Q)	97.354
2006 (2Q)	98.139

(Continued)

Year / Period	Deflator (2007 = 100)
2007	100.000
2007 (1Q)	98.977
2007 (2Q)	102.753
2008	101.719
2008 (1Q)	100.896
2008 (2Q)	102.542
2009	102.254
2009 (1Q)	102.029
2009 (2Q)	102.479

Remarks:

- Data for 1950-1960: Official estimation based on retail price index, wage index and fuel index (see Ch.4: 47);
- Data for 1961-2009: GDP deflator

(Source: 1950-1960: *General Correspondence Files* available at the Public Records Office;
1961-2009: *Annual reports of Hong Kong*. H.K.: Govt. Printer)

Appendix 4 – Operating Statistics of bus companies in Hong Kong

Kowloon Motor Bus (K.M.B.): 1950 – 2009:

Year	Bus Fleet	No. of Routes operated	Operating Mileage (million km)	Passenger-journey (millions)	% of total public-transport journeys
1948	152	20	15.53	56.50	-
1949	191	24	18.11	90	-
1950	250	25	20.92	123.25	-
1951	180	27	22.93	168.73	36.70%
1952	355	29	24.94	177.90	37.43%
1953	350	31	26.55	189.10	38.03%
1954	370	34	28.57	203.25	39.36%
1955	370	34	30.98	223.20	40.37%
1956	450	38	32.19	244.09	41.04%
1957	526	39	34.60	270.08	42.17%
1958	526	41	37.82	291.55	42.68%
1959	512	41	39.11	322.08	44.53%
1960	563	45	47.96	381.71	46.92%
1961	721	56	56.33	435.52	48.79%
1962	777	59	62.36	481.57	49.30%
1963	886	61	63.73	515.17	49.79%
1964	946	63	64.86	548.15	50.04%
1965	1,004	64	73.50	593.22	50.93%
1966	1,055	65	75.96	643.12	51.84%
1967	1,051	65 (49)	52.30	515.54	48.77%
1968	1,050	65	64.53	610.75	50.93%
1969	970	67	67.21	611.46	49.76%
1970	1,018	71	65.02	568.01	48.81%
1971	1,122	76	65.15	547.57	47.92%
1972	1,272	84	71.45	501.19	46.83%
1973	1,324	92	74.19	493.69	48.36%
1974	1,371	106	88.35	564.49	50.38%
1975	1,560	149	101.39	634.56	52.16%
1976	1,700	162	112.65	716.43	55.64%
1977	1,708	173	117.90	810.93	57.86%
1978	1,804	196	117.64	860.48	58.34%
1979	1,867	212	113	934.34	57.64%
1980	2,089	31	122	911.66	51.71%
1981	2,390	18	134	933.03	50.38%
1982	2,369	207	140	940.40	46.91%
1983	2,380	192	160	981.82	45.09%
1984	2,441	198	170	1,069.32	45.87%

(Continued)

Year	Bus Fleet	No. of Routes operated	Operating Mileage (million km)	Passenger-journey (millions)	% of total public-transport journeys
1985	2,511	207	188	1,079.05	44.49%
1986	2,740	235	210	1,108.29	43.94%
1987	2,900	243	220	1,088.36	31.91%
1988	2,770	239	216	1,081.83	30.87%
1989	2,849	251	201	973.89	27.30%
1990	2,887	286	195	965.86	26.92%
1991	3,037	282	217	968.08	26.87%
1992	3,121	305	234	970.65	26.58%
1993	3,197	347	243	965.85	26.11%
1994	3,369	355	255	976.67	25.79%
1995	3,507	357	271	995.10	26.03%
1996	3,597	357	285	1,031.89	26.36%
1997	3,839	371	300.19	1,051.10	26.98%
1998	3,991	387	328.75	1,034.35	26.77%
1999	4,064	385	343.58	1,060.01	27.21%
2000	4,238	381	360.32	1,089.18	28.28%
2001	4,371	387	384.88	1,111.17	28.50%
2002	4,430	388	349.91	1,134.35	28.57%
2003	4,284	456	344.30	1,060.51	27.76%
2004	4,141	450	342.79	1,063.85	26.31%
2005	4,021	447	338.98	1,009.94	24.77%
2006	4,013	446	336.22	1,007.87	24.30%
2007	4,027	444	331.16	1,008.14	23.97%
2008	3,880	420	325.40	986.49	23.61%
2009	3,879	396	320.78	965.16	23.31%

Remarks:
- Only operational data for franchise bus operation is included
- Size of the Bus Fleet and Bus Routes are counted at year-end
- Only the number of licensed franchised buses are counted
- The above data set does not include operational statistics of the Long Win Bus

China Motor Bus (C.M.B.): 1950 – 1998:

Year	Bus Fleet	No. of Routes operated	Operating Mileage (million km)	Passenger-journey (millions)	% of total public-transport journeys
1948	108	10	4.83	20	-
1949	128	11	7.24	36	-
1950	144	12	8.53	43.6	-
1951	151	15	9.82	46.12	10.03%
1952	170	16	10.94	50.79	10.69%
1953	172	16	11.75	54.15	10.89%
1954	188	18	11.93	55.95	10.84%
1955	193	18	12.55	65.05	11.77%
1956	200	18	13.04	67.92	11.42%
1957	221	18	13.52	72.09	11.26%
1958	239	18	14.81	79.61	11.65%
1959	249	19	16.09	87.18	12.05%
1960	300	22	17.70	106.57	13.10%
1961	307	26	19.31	120.12	13.46%
1962	325	27	21.77	134.20	13.74%
1963	360	27	22.85	143.03	13.82%
1964	394	31	24.62	158.67	14.48%
1965	459	31	26.72	169.26	14.53%
1966	498	31	30.09	186.56	15.04%
1967	502	27	24.62	169.15	16.00%
1968	483	31	30.09	201.11	16.77%
1969	487	36	27.97	212.88	17.33%
1970	499	36	26.07	185.80	15.97%
1971	483	37	24.62	175.11	15.33%
1972	496	39	20.86	136.20	12.73%
1973	565	39	28.32	163.60	16.03%
1974	595	47	33.96	197.00	17.58%
1975	629	60	40.39	215.76	17.74%
1976	702	80	42.16	231.70	17.99%
1977	751	84	41.52	239.61	17.09%
1978	820	100	40.88	254.69	17.27%
1979	848	99	39.59	274.32	16.92%
1980	985	117	42.65	275.53	15.63%
1981	1,028	102	44.10	298.20	16.10%
1982	1,047	107	49.25	328.50	16.39%
1983	1,090	95	53.91	357.60	16.42%
1984	1,076	104	55.30	363.50	15.59%
1985	1,054	100	54.90	344.03	14.19%
1986	1,019	115	55.60	318.40	12.62%

(Continued)

Year	Bus Fleet	No. of Routes operated	Operating Mileage (million km)	Passenger-journey (millions)	% of total public-transport journeys
1987	925	116	54.60	318.40	9.34%
1988	1,008	99	51.00	317.61	9.06%
1989	1,006	105	50.40	298.81	8.38%
1990	1,026	109	52.30	280.88	7.83%
1991	1,020	122	52.20	267.15	7.42%
1992	1,027	130	51.30	262.43	7.19%
1993	1,014	129	45.00	235.67	6.37%
1994	961	131	44.30	196.80	5.20%
1995	883	87	44.00	190.97	4.99%
1996	853	85	45.50	179.21	4.58%
1997	823	115	46.25	176.45	4.53%
1998[1]	746	126	30.30	104.92	2.71%

Remarks:
- Size of the Bus Fleet and Bus Routes are counted at year-end
- Only the number of licensed franchised buses are counted
- Franchise bus operation of CMB was terminated on 30th August 1998

[1] Data is recorded up to 30th August, 1998

Citybus (C.T.B.): 1991 – 2009:

Year	Bus Fleet	No. of Routes operated	Operating Mileage (million km)	Passenger-journey (millions)	% of total public-transport journeys
1991	9	1	-	0.18	0.01%
1992	9	1	-	0.96	0.03%
1993	200	26	3.60	22.20	0.60%
1994	144	39	12.00	67.70	1.79%
1995	338	55	17.11	87.50	2.29%
1996	407	58	25.00	119.69	3.06%
1997	590	84	36.83	147.75	3.79%
1998	955	107	64.58	183.30	4.74%
1999	959	107	83.65	203.01	5.38%
2000	960	107	82.59	213.31	5.54%
2001	957	110	82.05	216.48	5.55%
2002	956	112	83.72	220.38	5.55%
2003	940	113	82.83	207.34	5.43%
2004	911	112	84.20	210.80	5.21%
2005	910	112	82.30	205.08	5.03%
2006	909	111	82.36	207.76	5.01%
2007	919	112	82.58	210.45	5.00%
2008	925	110	82.67	209.10	5.00%
2009	931	110	82.01	206.61	4.99%

Remarks:
- Only operations of the franchise bus division is included
- Size of the Bus Fleet and Bus Routes are counted at year-end
- Only the number of licensed franchised buses are counted
- The data set include franchise bus operations on the North-Lantau Island (Franchise 2)

New World First Bus (N.W.F.B.): 1998 – 2009:

Year	Bus Fleet	No. of Routes operated	Operating Mileage (million km)	Passenger-journey (millions)	% of total public-transport journeys
1998	841	93	13.84	46.96	1.22%
1999	703	93	50.38	160.37	4.25%
2000	730	94	55.48	186.52	4.84%
2001	757	97	56.69	194.49	4.99%
2002	769	99	60.94	195.45	4.92%
2003	730	102	59.41	180.54	4.73%
2004	695	98	56.43	184.63	4.57%
2005	694	95	52.07	177.48	4.35%
2006	694	94	50.92	183.08	4.41%
2007	694	94	50.39	184.38	4.38%
2008	713	91	49.40	175.47	4.20%
2009	705	91	48.78	171.89	4.15%

Remarks:
- NWFB started its operation on 1 September 1998
- Size of the Bus Fleet and Bus Routes are counted at year-end
- Only the number of licensed franchised buses are counted

New Lantao Bus (N.L.B.): 1973 – 2009:

Year	Bus Fleet	No. of Routes operated	Operating Mileage (million km)	Passenger-journey (millions)	% of total public-transport journeys
1973	41	-	-	1.75	0.17%
1974	42	-	-	1.23	0.11%
1975	42	5	1.17	1.37	0.11%
1976	44	5	1.41	1.53	0.12%
1977	45	5	-	2.01	0.14%
1978	53	5	-	2.20	0.15%
1979	58	6	-	2.48	0.15%
1980	56	6	-	2.80	0.16%
1981	59	6	-	3.13	0.17%
1982	61	6	-	3.38	0.17%
1983	58	8	-	3.17	0.15%
1984	57	8	-	3.17	0.14%
1985	58	10	-	3.19	0.13%
1986	56	8	-	3.03	0.12%
1987	55	8	-	3.23	0.09%
1988	60	9	-	3.44	0.10%
1989	56	9	-	3.88	0.11%
1990	59	8	-	4.23	0.12%
1991	65	9	-	4.29	0.12%
1992	76	7	-	3.99	0.11%
1993	56	7	-	4.11	0.11%
1994	74	8	-	6.50	0.17%
1995	69	8	-	5.38	0.14%
1996	69	9	2.75	5.27	0.13%
1997	80	13	3.64	5.92	0.15%
1998	87	20	4.75	6.21	0.16%
1999	86	23	5.10	5.45	0.14%
2000	84	22	4.99	5.51	0.14%
2001	79	23	4.86	6.83	0.18%
2002	78	25	4.99	8.96	0.23%
2003	80	25	5.08	9.68	0.25%
2004	86	24	5.40	12.06	0.30%
2005	86	23	5.32	13.35	0.33%
2006	83	22	5.08	14.05	0.34%
2007	94	23	5.51	16.15	0.38%
2008	102	22	5.76	17.19	0.41%
2009	104	24	6.10	18.04	0.44%

Remarks:
- NLB was granted a franchise since 1st April 1974
- Size of the Bus Fleet and Bus Routes are counted at year-end
- Only the number of licensed franchised buses are counted

Long Win Bus (L.W.B.): 1998 – 2009:

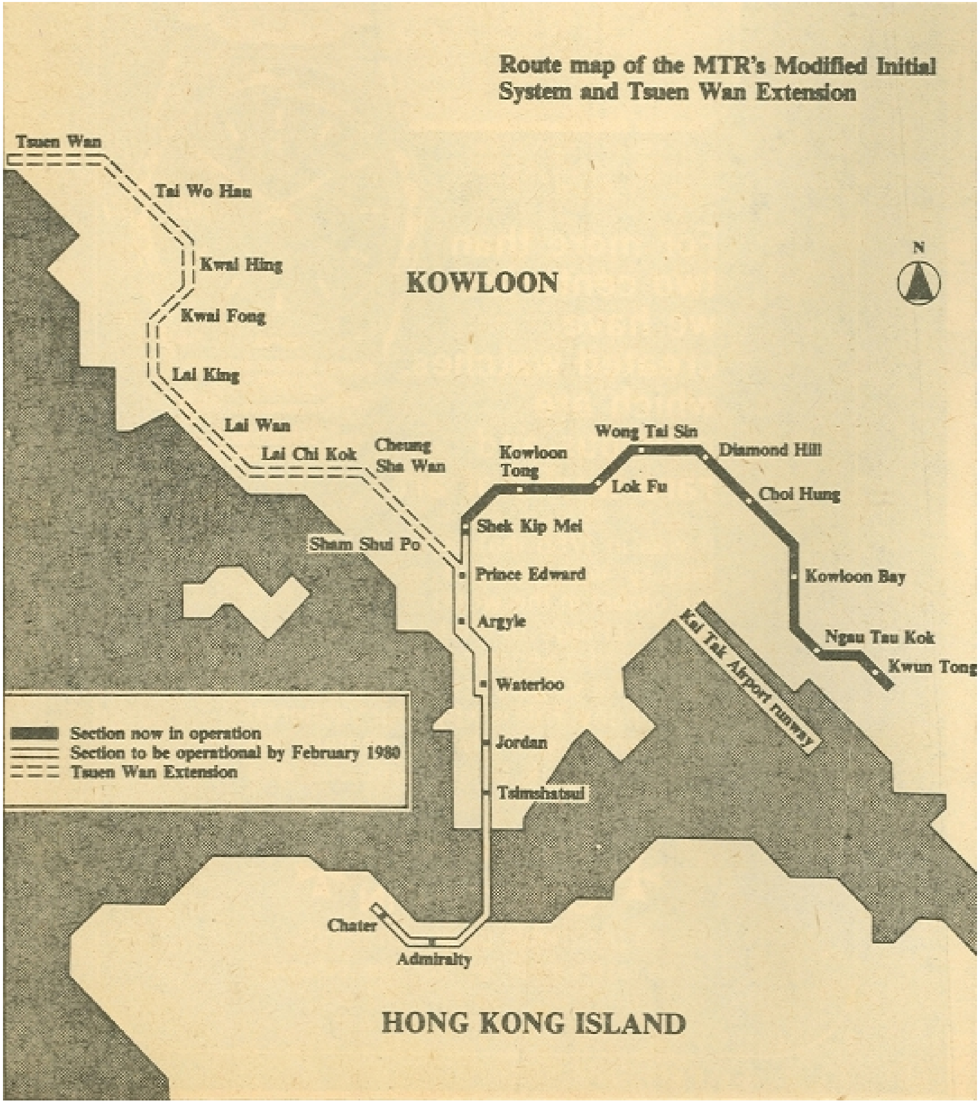
Year	Bus Fleet	No. of Routes operated	Operating Mileage (million km)	Passenger-journey (millions)	% of total public-transport journeys
1997	22	1[1]	1.43	2.88	0.07%
1998	160	14	16.04	14.36	0.37%
1999	159	15	24.87	16.90	0.45%
2000	159	15	22.56	17.25	0.45%
2001	160	15	22.77	19.00	0.49%
2002	145	15	23.14	20.31	0.51%
2003	145	15	22.65	19.26	0.50%
2004	144	15	23.46	22.31	0.55%
2005	146	18	23.79	24.29	0.60%
2006	153	18	24.46	26.51	0.64%
2007	159	18	24.94	27.67	0.66%
2008	157	18	25.60	28.87	0.69%
2009	167	19	25.78	28.16	0.68%

Remarks:
- Long Win Bus commenced its operation in May 1997
- Size of the Bus Fleet and Bus Routes are counted at year-end
- Only the number of licensed franchised buses are counted

[1] Only the route E31 is operated by LWB at the end of 1997

Appendix 5 - Route map of the MTR in Hong Kong

Route map of the initial MTR system by the end of 1979:

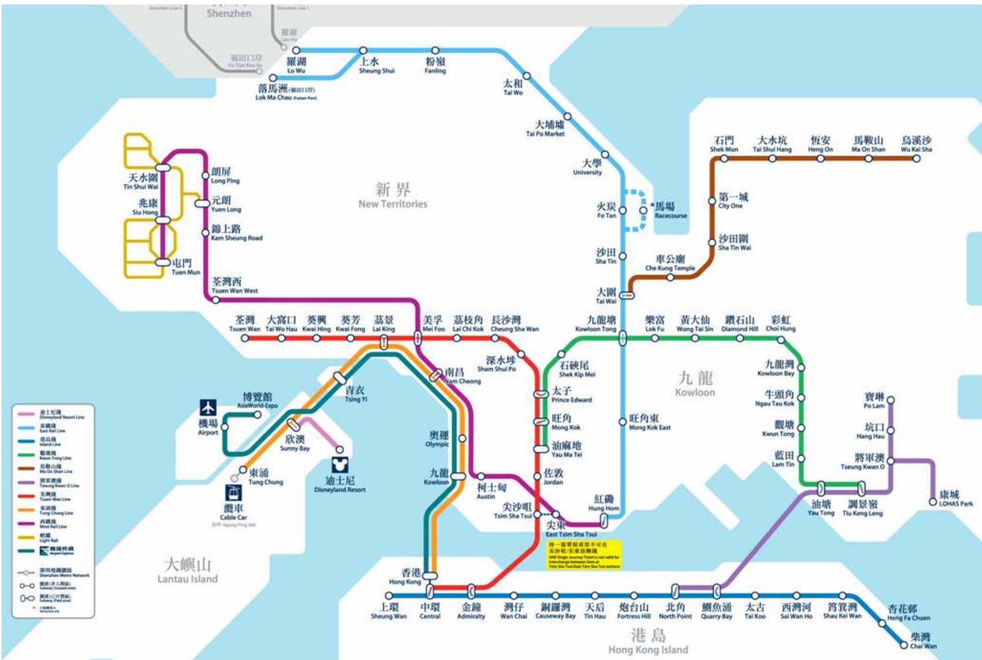


(Source: P.16, *The Asia Magazine*, 10 January 1980)

Remarks:

- 'Modified Initial System' was the name of the early network of MTR system when it commenced its services on 30 September 1979.
- Shek Kip Mei to Kwun Tong: Commenced on 1 October 1979.
  Tsimshatsui to Shek Kip Mei: Commenced on 16 December 1979.
  Chater to Tsimshatsui: Commenced on 12 February 1980.

Route map of the MTR system in 2010:



(Source: Website of the Mass Transit Railway Corporation, http://www.mtr.com.hk)

Remarks:

- Kowloon Canton Railway Corporation (KCRC) was merged with MTRC on 2 December 2007.

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